BI Norwegian Business School - campus Oslo

GRA 19502

Master Thesis

Component of continuous assessment: Thesis Master of Science
Final master thesis – Counts 80% of total grade

How has the mortgage regulation implemented in 2017 affected house prices in Oslo?

Navn:	Susanne Solfjeld, Marius Vedum Thomassen

Start:	02.03.2018 09.00
Finish:	03.09.2018 12.00

Susanne Solfjeld

Marius Vedum Thomassen

Master of Science in Business, major in Finance

Date of Submission: 03.09.2018

Acknowledgments

We wish to thank our helpful supervisor, Artashes Karapetyan, for his valuable advice and guidance along the way.

We would also like to express our gratitude to Real-Estate Norway (Eiendom Norge), OBOS and Kartverket for their kind assistance with the data collection.

Content

Abstract

We show that regulatory mortgage and equity restrictions, implemented in Oslo in 2017, leveled the abnormal house price surge. Results indicate that both regulatory measures analyzed in this thesis are causing the price reduction. The paper provides evidence that the 40 percent equity requirement on secondary homes affects investors particularly. Despite this feature investor-based real-estate acquisitions increased post regulation, which is probably a result of the equity growth stemming from the price hike pre-regulation.

1.0 Introduction and motivation

House price determinants have been the subject of an escalated focus over the last decade. This surge in interest is triggered by the increasing impact house prices have in a country's economy. In Norway this has been especially prominent due do to the extraordinary rise in real-estate prices since the millennial shift.

Since 1965 Norway's economy has been strongly influenced by the discovery of oil, moving from a financially challenged state into a prosperous state of welfare. In recent times the housing investments have overtaken the oil industry as Norway's main driver of economic growth (Thomson Reuters, 2017). The housing market in Norway differs from most countries in that 80% of Norwegians are homeowners (SSB, 2016a). This elaborates its influence in the economy and can be highlighted by the following; in the US with 316 million inhabitants, households hold close to 18 trillion USD in real estate assets (Agarwal, Driscoll & Laibson, 2013). In Norway, with a population of 5 million, inhabitants own real estate amounting to 0.9 trillion USD (SSB, 2012). That is, each US inhabitant own approximately 57 000 USD in real estate assets, while in Norway they own assets of 180 000 USD (Agarwal & Karapetyan, 2016).

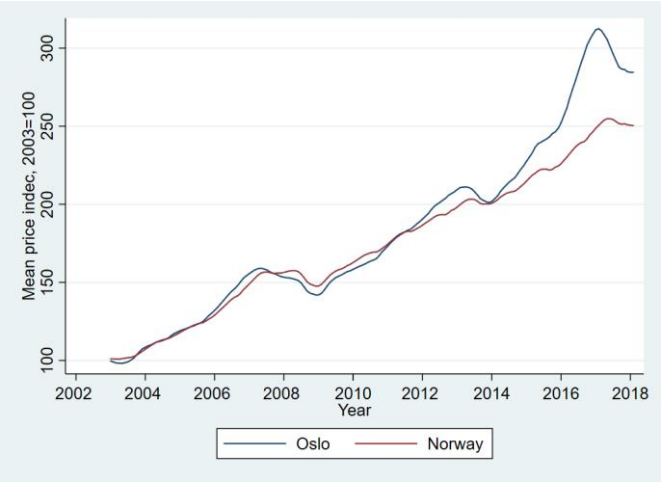

Figure 1.0: *The figure shows the average price index in Oslo compared to Norway (excluding Oslo). The price index is normalized around 100 in 2003. Data obtained from OBOS and Real-Estate Norway (2018).*

Since 2000 house prices in Norway have had an upturn of over three hundred percent. In Oslo the rise in prices amounts to five hundred percent, six times

higher. This development has prompted a number of governmental regulations trying to prevail the price growth and the following debt-level. In 2017 the government implemented mortgage regulations governing bank lending activities, and consumer equity requirements. These restrictions were built upon and developed from already existing modulates, which were implemented in 2015[1]. The abnormal surge in house prices in Oslo induced the government to put in place additional regulations applicable in the capital. This paper seeks to investigate whether these had any effect beyond the effect of the nationwide regulations.

1.1 Housing market in Norway

The growing house price trend over the last 20 years has been continuous except for 2008 when they experienced a small decline. Since then, the housing price has been booming every year with an increase in price per square meter of 75% on a national basis[2]. Homes constitute two-thirds of gross household wealth (Murtin & d'Ercole, 2015) and are one of the most important assets for households. Having a place to live is viewed as a necessary need and nearly everyone will be affected by the housing market during their lifetime. Attributes of house prices are also interesting for financial authorities and central bankers. Larsen and Sommervoll (2004) state that housing loans make up a large proportion of credit creation in an economy. Oslo is the city in Norway with the highest credit creation in the economy (Business Insider, 2012). The value of housing affects the security of mortgages, which further influence the macroeconomic performance.

1.2 Housing price market in Oslo

Approximately 20 percent of the Norwegian population live in Oslo (SSB, 2017). Oslo and its surrounding areas tend to have the highest income per habitant and the highest house prices in Norway (SSB, 2017). This characteristic might indicate equal demographic areas (Tennøy, 2002). While the whole country has experienced a sharp increase in house prices over the last decade, the growth has been superior in Oslo amounting to a growth of price per square meter of 86 percent (SSB, 2017). Prices, population and demand vary a lot in different areas in Oslo (Tennøy, 2002). The capital has the highest amount of wealthy people, as

[1] See table 1 for summary of legislative measures regarding house mortgages
[2] Real Estate Norway, 2018, http://eiendomnorge.no/boligprisstatistikken/

well as people with little wealth, and this gives us high variation in wealth and income[3]. As presented by the media numerous times over the years, the differences in income are biggest for west and east in Oslo, where people living in the east have the lowest income and people in the west have the highest income. These differences are present in house prices as well, where house prices in west Oslo are higher than in the eastern area.

1.3 Regulatory changes aimed at restraining the housing market

Homeownership in Norway has been a policy goal since 1960 (Real Estate Norway, 2018a). The purpose of regulatory measures have been to make house ownership more attractive than renting. The governmental incentives include tax benefits of credit, tax relief on capital gains when selling your apartment/house[4], in addition to a low appraised value of the property for tax purposes. This way of incentivizing Norwegians towards ownership is often referred to as the Norwegian real-estate model (Global Property, 2018). The real-estate market in Oslo is the most expensive housing price market in Norway (Gjerstad, 2016), and has been subject to additional regulations during the strong appreciation of house prices. The policies aim at obtaining financial stability. The positive price development continued until 2017, indicating that the strict capital requirements and loan-to-value limits during the last 10 years did not manage to contain the positive development up until this point. The regulations in 2017 were implemented as an initiative by the Financial Supervisory Authority (FSA) as the housing prices continued to grow substantially more than the household income (FSA, 2016). They were initiated because of the rising average debt-to-income ratio, which amounted to 220% and because the NOK had weakened due to investor worries regarding the housing market. In this paper we wish to investigate how regulations imposed by the government in Oslo have affected the housing price market.

In Norway among 15%[5] of all homes are secondary homes (NEF, 2016). A secondary home is where the owner does not live in the house/apartment they own, but instead buys it for investment purposes or other. In Oslo, the number of secondary homes is higher than the national standard, amounting to 19,5%[6]

[3] NRK, 2015, https://www.nrk.no/norge/ti-grafer-som-viser-forskjells-oslo-1.12521009
[4] Provided that you have lived there for a minimum of 12 months (Skatteetaten, 2018).
[5] This number excludes leisure housing.
[6] This number excludes leisure housing

(Sandberg, 2016). Although the number of secondary homes is very high in the capital, it varies significantly within the city lines. The center of Oslo contains 66,1% secondary homes and Frogner contains 35%. An overall average of 19% would therefore imply that in some areas secondary homes constitute much less than 19%, underlining the high variation across Oslo. It has been argued that this high amount of investors buying homes is the main reason for the steep price increase. If this is true the regulations should cause most of the price change in 2017. This area of study, being so recent, has yet to be investigated. Thereby, our research will contribute to existing theories regarding the housing market of Norway.

1.4 Research Question

In our analysis we look into how regulations imposed by the government in 2017 have affected the house prices in Oslo. The existing economic literature does not pay adequate attention to these issues.

The research question we will seek to answer is the following:
How has the mortgage regulation implemented in 2017 affected house prices in Oslo?

The remainder of the paper will be organized as follows: Chapter 2 provides a literature review presenting the empirical evidence and theory on the topic, chapter 3 presents a simple description of methodology to be used in our research, chapter 4 includes a description of the dataset, variables and comments, chapter 5 presents the results of our analysis and further comments and finally chapter 6 concludes and make suggestions for further research.

2.0 Literature review

This section contains previous findings and studies on some of the most relevant areas in relation to our analysis.

2.1 Housing Market

The real-estate market is characterized by large fluctuations surfacing over time. This particular trait has prompted a number of papers investigating the efficiency on the housing market over the years. According to Malkiel (2003) a market is categorized as efficient if it fully and correctly reflects all relevant information in determining asset prices. Larsen and Weum (2008) studied the efficiency in the Norwegian housing market during 1991-2002 by looking at a rich number of transactions in the period. They find that the Norwegian Housing Market (represented by Oslo) is characterized by inefficiencies. The article utilizes the Case-Shiller efficiency test[7] and finds that the Oslo housing market fails the test as both repeat-sales house price index and returns to housing display time structure. Inefficiencies in the house price market may indicate that precautionary interventions taken by the government will not have an immediate effect on the market.

Governments worldwide have implemented a number of policy interventions trying to obtain financial stability. According to the Bank of Norway (Olsen, 2017) the purpose of a policy intervention is to keep the housing market sustainable over the long run. Bjørnland and Jacobsen (2010) find that house prices react strongly to monetary policy shocks, contradicting the findings of Larsen and Weum to some extent. In the article they analyze the relationship between interest rate changes and housing prices in the UK, Sweden and Norway. The paper finds that overall house prices fall 3 to 5 percent following a monetary change in the interest rate by 1 percent. This is in line with expectations as an increase in interest rates would increase the cost of mortgages.

[7] The Case-Shiller efficiency test was developed by Karl E. Case and Robert E. Shiller in their article from 1989. The method was developed to cope with the problem of serial correlation when testing efficiency. A closer description of the method is presented in Case & Shiller (1989) page 129.

In the aftermath of the financial crisis the Norwegian central bank facilitated a series of interbank mortgages to alleviate the falling housing prices[8]. Larsen (2018) studied the following price differences between this policy reversal and bond swap agreement. He found evidence that the monetary policy had a significant role in the housing market recovery in 2008. The Norwegian housing market distinguished itself immensely compared to the international market by only experiencing a small depression during the crisis.

2.2 Credit Constraints

Government intervention comes in many shapes and forms other than the ones mentioned. Research regarding equity restrictions and debt constraints are meager. Larsen and Sommervoll (2003) study the housing market in Norway and underline that access to credit is crucial for a proper functional housing market. The credit conditions are linked to the economic situation as credit is given on the assessment of a borrower's ability to pay. Reducing the amount accessible to the borrower will then most likely affect the housing market. This is supported by the empirical result from Linneman and Wachter (1989), and Zorn (1989). They provide evidence that down-payment requirements constrain households when acquiring a home. The evidence is also present in well-developed capital markets (Linneman & Wachter, 1989). Haurin, Hendershott and Wachter (1996) have provided evidence in line with this view. The article shows that ownership tendencies are quite sensitive to economic variables, specifically borrowing constraints. It looks at the impact of mortgage lender imposed borrowing constraints. Their results suggest that the constraints reduce the probability of house ownership by 10 to 20 percentage points depending on the particular characteristics of the household.

The opposite effect is demonstrated as well. Mian and Sufi (2009) established a consensus that credit expansion fuels consumers' appetite for mortgages. Curiously, the evidence is found during 2002-2005, a time where income growth and mortgage credit growth were negatively correlated. These characteristics are not as prevalent as they were only present in the course of the financial crisis. The

[8] On 12 October 2008 the Norwegian central bank provided a package of measures to give banks better access to liquidity and financing, including fixed rate loans and swap arrangements. An overview of the arrangement is presented in the report from the Financial Supervisory Authority in 2008 (published in 2009): «The Financial Market in Norway 2008; Risk Outlook».

result may therefore not hold in general. Eerola and Määttänen (2017) on the other hand analyzed the time interval 1985-2010 and found consistent evidence. This period is subject to both volatile conditions (banking crisis of 1990 and financial crisis 2008) and more stable circumstances, providing more general conclusions. Their results on the Finnish housing market implied that a tighter borrowing constraint induced housing transactions solely if the seller is willing to accept a lower price. This is aligned with the evidence presented above, and indicates that a tighter borrowing constraint would most likely reduce housing prices.

2.3 Equity Restriction

A house purchase typically requires a down-payment or a deposit. The reason is usually associated with the adverse selection and moral hazard issues facing lenders (Benito, 2006). When analyzing U.S. mortgage contracts Caplin et al. (1997) state that it is almost impossible to buy a home without available liquid assets of at least 10% of the home's value. Benito (2006) finds a positive correlation between demand for housing and house price transactions. He further explains this by the price inflation accumulating the necessary down-payment requirement, which is shown to be true for 83% of former owner-occupiers. This evidence may indicate that an equity restriction reduces the demand for houses, and as a result prices decrease.

As we can see, the existing evidence is scarce. There seems to be a consensus among researchers that monetary policies tend to have an impact on housing prices. A large part of the research present today has focused on the years during the financial crisis. These papers may not provide results representing the market in general, and one may therefore not make inferences from them. By considering the articles where the financial crisis were not in focus, it seems plausible that both an equity restriction and debt constraint singularly should stop the housing prices from surging further. Combined they should yield an even stronger effect. It is evident that gaps in the literature are present. The financial crisis in 2008 prompted a number of analyses focusing on house markets worldwide. Studies providing evidence on a more general basis are paramount. With our analysis we wish to fill this gap by studying the direct effect of both a debt constraint and equity restriction combined.

3.0 Methodology

This paper's contribution is empirical. We seek to investigate whether the regulations imposed in Oslo did have an additional effect over the regulations put in place nationwide.

3.1 How has the mortgage regulation implemented in 2017 affected house prices in Oslo?

In order to distinguish the effect in Oslo from the nationwide effect we will utilize a difference-in-difference (DD) methodology. DD methods are a common strategy for evaluating the effects of policies or programs that are instituted at a particular point in time, such as the implementation of a new law (Stuart et al., 2014). The DD method weighs development over time in a control group unaffected by the legislative intervention against a "treatment" group affected by the legislative intervention, and attributes the "difference-in-differences" to the legislative effect. By looking at both the treatment and the control group, before and after the event, the method avoids the effect of extraneous factors.

For the method to capture what is intended the DD estimator need to be unbiased and a consistent estimator of the causal effect, i.e. that the treatment (the Oslo regulations) need to be randomly assigned. According to Stock and Watson (2014, p. 543) the "treatment" (in our case policy implementation being located in Oslo and not elsewhere), is viewed "as if" randomly assigned in the sense that being subject to the regulatory changes is assumed to be uncorrelated with the other determinants of house price changes over this period. This is in accordance with the experiment conducted by Card and Krueger (1994), which lets geography perform the randomization for them. By this we believe that the estimator is both a consistent estimator of the causal effect as well as unbiased. However, we do address the potential concerns about the experiment being non-random later in the analysis.

The key assumption regarding the DD methods is called the parallel trend. It states that DD methods provide unbiased effect estimates if the trend over time would have been the same between the intervention and comparison groups in the

absence of the intervention. The fulfillment of this assumption is displayed and discussed in chapter 4.

3.1.1 Widespread methodology

DD method indicates looking at a treatment group (where the effect you want to measure is implemented) and a control group (where the change was not implemented), and compare the two in order to evaluate the effect of the change (Roberts & Whited, 2013). DD is often used to measure the effect of a policy change. Examples of this are Garvey and Hanka, and Bertrand and Mullainathan. Garvey and Hanka (1999) utilized DD to estimate the effect of a state antitakeover laws on leverage in the U.S. during the 90s. They compared the firms in states that passed the law (treatment group), with the firms in the state that did not pass the law (control group). Bertrand and Mullainathan (2003) also studied the effect of antitakeover legislation in the U.S., but solely in the state of Arizona. Arizona had passed an antitakeover legislation which Connecticut had not. The paper used the year where the legislation was implemented, 1987, as the post-treatment year, and the year before, 1986, as the pretreatment year. Further, firms registered in Arizona represented the treatment group, and firms registered in Connecticut represented the control group. These papers have numerous equalities to our analysis as they are evaluating the effect of a policy implementation.

DD is not only widespread when it comes to policy changes, but also in abrupt changes in the social environment. Card (1990) study the effect of immigration on low-skilled workers' wages. He used DD to compare the change in wages in Miami with the change in wages in other U.S. cities. The methodology is also widely used to estimate effects on the labor market (Jeon, 2004).

The most recent research similar to our analysis is the one by Agarwal and Karapetyan (2016). The authors evaluate the effect of regulatory disclosure of hidden debt in Norway 2008. Here they identify a large mispricing in housing which is eliminated by the regulation. They further conclude that lack of salience is the main source of bias.

In this thesis we will look at how the interstate regulations implemented in 2017 have affected the house prices in Oslo. Akershus and Buskerud represent the control group, i.e. the area not affected by the regulation.

On a monthly time interval, the basic regression we estimate is:

(1)

$$P_i = \propto + \beta_1 Oslo + \beta_2 * Post + \beta_3 (Oslo * Post) + \beta_4 GDP + \beta_5 Unemp_i + \beta_6 Income_i + X\delta + \varepsilon$$

P_i is the dependant variable of interest (house prices), $Oslo$ is a dummy variable equal to 1 if the area is in Oslo, $Post$ is a dummy variable equal to 1 if the year is 2017, X is the quarterly fixed effects, $(Oslo * Post)$ is the DD estimate which is a dummy variable that equals 1 if the year is 2017 and the area is Oslo, and ε is the error term. The quarterly fixed effects account for aggregate fluctuations. The control variables, GDP, $Income_i$, and $Unemp_i$ (Unemployment), account for fixed effects between real-estate prices in Oslo relative to Akershus and Buskerud. Our estimate of the regulatory effect is β_3.

The control variables are chosen because they explain much of the financial aspects of the economy (Bank of Norway, 2011).

The hypothesis we will test is the following:
H0: The Oslo specific regulations did not have a significant effect on the house prices in Oslo
HA: The Oslo specific regulations did have a significant effect on the house prices in Oslo

4.0 Data

Since we wish to investigate whether the Oslo specific regulations have had any effect, we collected historical data on house prices, income, GDP and unemployment in the time period 2012-2017[9]. Our variables are made stationary by using their percentage changes, due to the volatile period and short time interval. Where monthly intervals were not available the data was converted using Eviews[10].

4.1 Variables

4.1.1 House prices

The house prices were gathered from both Real Estate Norway (Eiendom Norge) and OBOS. Real Estate Norway provided us with a monthly price index of counties and municipalities in Norway. They develop their data in cooperation with Finn.no and Eiendomsverdi. The statistics include homes that have been advertised on Finn.no, that is, about 70 percent of all homes being traded in Norway over a year (Real Estate Norway, 2018b). The data from OBOS contains monthly average housing prices (including common debt) in Oslo, consisting of: Grorud, Stovner, Alna, Bjerke, Gamle Oslo, Nordstrand, Søndre Nordstrand, Vestre Aker, Nordre Aker, Østensjø, Grunerløkka, St. Hanshaugen, Sagene, Frogner and Ullern. The dataset originally consisted of average square meter prices in each area. In order for this dataset to be comparable from the one we obtained from Real Estate Norway, we changed the average monthly prices into index form, equal to the one used by Real Estate Norway. The price index is normalized to 100 at the start of our dataset (2012), in order to show comparable levels of the index.

4.1.2 Income

The income data originated from Statistics Norway (SSB). The dataset contained an income index containing yearly average after-tax household income for all Norway's municipalities. Income data for district-level Oslo were collected from Oslo Municipality's own statistical database, which stems from SSB as well. This

[9] The income variables for districts in Oslo were available from 2012 and forward.
[10] In order to create monthly data we used the frequency conversion method called quadratic match-average in Eviews. This method estimates the missing values by generating a nonlinear function based on the known values.

was the yearly average income after tax of the respective population. In order to obtain comparable datasets, we used index theory to transform the data for Oslo into index data.

4.1.3 Unemployment

Unemployment numbers were gathered from SSB. The numbers stem from SSB's labor force survey (AFK) which collects data on both the ones applying for jobs while receiving financial support from the Norwegian Labor and Welfare Service (NAV), and the ones that do not receive this benefit. This makes up the most comprehensive measurement of unemployment available (SSB, 2015a). SSB register unemployment in the age group 15-74 years. Unemployment data over the different districts of Oslo were collected from Oslo Municipality's own statistical database, which stems from SSB. The data for the rest of Norway were gathered directly from SSB. The numbers represent the yearly total amount of people unemployed in the respective area. It would be beneficial to have the figures in percentage of the population in each area, but due to data limitation, it was not feasible.

4.1.4 Gross domestic product (GDP)

The GDP data were gathered from SSB. GDP is the value of a country's total produced domestic goods and services in a given year or quarter, valued at market prices (Steigum, 2010). Gross domestic product (GDP) is an important economic size that says something about the state and development of a country's economy. The figure is the sum of all goods and services produced in the Norwegian mainland within a year, minus the goods used in production.

4.2 Summary statistics

Table 2 summarizes our data. At first we provide an overview of the differences between Oslo and Norway, we then proceed by displaying the inequalities between Oslo and the large cities in Norway. This is followed by an introduction of the control group (Akershus and Buskerud) and Oslo, and finally, we present the metropolitan areas of Oslo. The GDP is the same for all areas as a more precise and detailed data were not available.

4.2.1 Differences Between Oslo and Norway

The mean price index in Oslo (131) is higher than in Norway (117), which is what we would expect to find. The difference between the means amounts to 11 percent. The income in the two areas shows higher inequalities. While the mean income index in Norway is 144, the index is 36 percent higher within Oslo (196). This may provide some explanations for the house price index being higher in the capital.

4.2.2 Oslo and Large Cities

The panel representing Oslo and large cities of Norway show similar patterns. The price index in the cities is lower than in Norway in general. This is somewhat unexpected, but is presumably a result of the cities characteristics. Kristiansand and Stavanger are the cities with the lowest price increase during 2016 according to Fædrelandsvennen (2017). The house price growth in Stavanger is strongly influenced by the hamper from the oil industry. Kristiansand claims to have a healthy development due to consistent construction building. By looking at the price development in 2015/2016 in figure 4.2 it is clear that the development in Oslo is superior to all large cities, although the difference varies a lot.

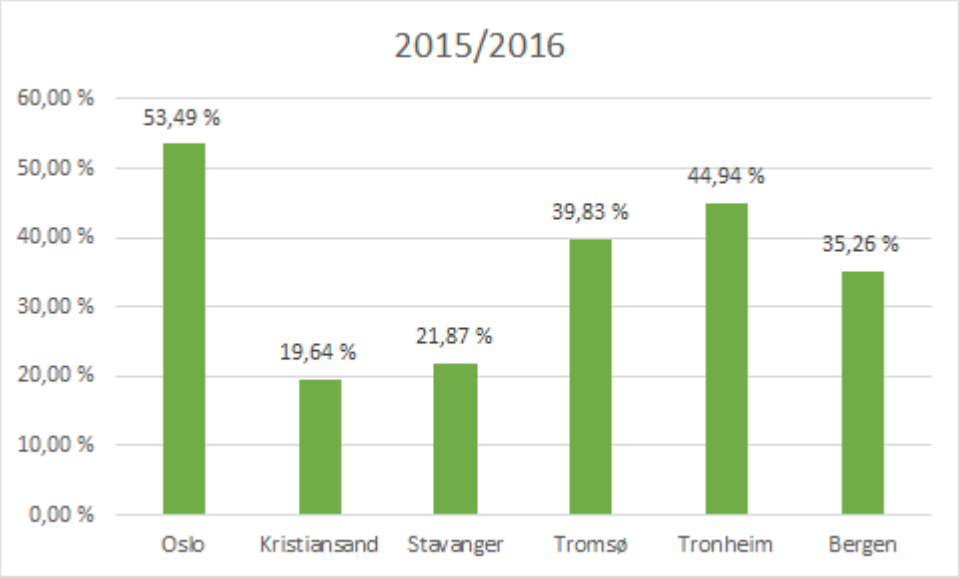

Figure 4.2: *The figure shows the mean annual house price index in the biggest cities in Norway in 2015/2016. Data gathered from Real-Estate Norway (2018).*

It should also be noted that the standard deviation of Oslo is higher (25) compared to large cities (6.14). Due to data limitation the income index and the

unemployment rate is the same in both Norway and large cities, and will therefore not be commented upon.

4.2.3 Oslo – Akershus and Buskerud

Akershus and Buskerud have followed a similar growth pattern as Oslo, see panel C in table 2. The mean house price index is the closest comparison to Oslo (121.44). The income index is also closer to each other here, Oslo having a mean of 196 and Akershus and Buskerud of 174. This might explain the house prices showing similarities.

4.2.4 Metropolitan Areas of Oslo

Summary statistics for metropolitan areas in Oslo are displayed in panel D table 2. The mean income level seems stable across all areas. Despite of this, the mean price level seems to vary, from Frogner having the highest (140.6) to Ullern having the lowest (119.5). Ullern also shows an abnormal mean regarding unemployment, and employs the lowest among all areas (634 people). The area containing the highest level of unemployment is Alna with a mean of 2129 people.

4.3 Verifying parallel trends

The main assumption for difference-in-difference regressions to be valid is called parallel trends. If the relevant variables move parallel over time pre-regulation, we have a case of the causal effect of the regulation on the variables in question. There are no statistical tests for this assumption, only visual observations over time. One can, however, perform DD tests for periods pre-regulation to confirm insignificant results. The assumption requires that in the absence of treatment, the difference between the ‘treatment’ and ‘control’ group is constant over time.

The dataset from Real Estate Norway includes data for all of Norway, and thereby we found it reasonable to create a control variable based on the complete dataset. We calculated a variable for Norway excluding Oslo, based on the available areas in our dataset. See Figure 1 for further details. Figure 4.3.1 shows a visual

representation of the parallel trend. Because Oslo had an increasing gap relative to Norway starting from 2015, it does not seem plausible that the assumption would hold. When performing DD analysis in the preceding years our concerns are supported. For the assumption to hold, the DD estimator should be statistically insignificant the years prior to 2017. Our results show an insignificant DD in 2013, 2014 and 2015, but significant at all levels in 2016, see results in panel A table 3. Despite being significant, the violation is harmless to the extent that the DD coefficient is positive.

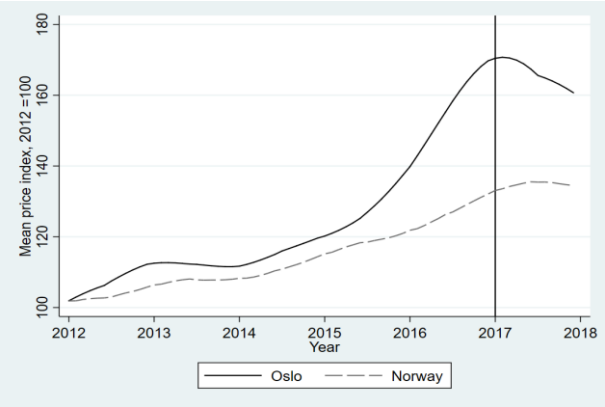

Figure 4.3.1: *The figure shows the average price index in Oslo compared to Norway (excluding Oslo). The price index is normalized around 100 in 2012. The vertical line represents the implementation of the regulation.*

Since the problem seems to be inherent in 2016, we take a closer look at the areas in Oslo during this interval. We find that the areas with the highest standard deviation, and the highest price increase during this period is Bjerke and Grorud, a part of the eastern area of Oslo. By removing these areas we hope to get better results regarding the key assumption by making the abnormal price increase in Oslo closer to the price increase nationwide.

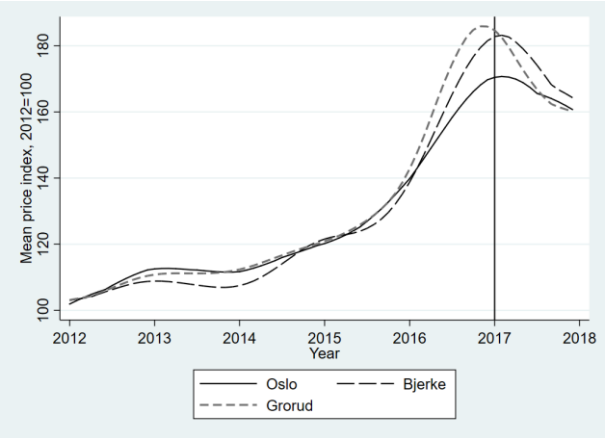

Figure 4.3.2: *The figure shows the average price index in Oslo compared to the index of Oslo Area Bjerke and Grorud. The price index is normalized around 100 in 2012. The vertical line represents the implementation of the regulation.*

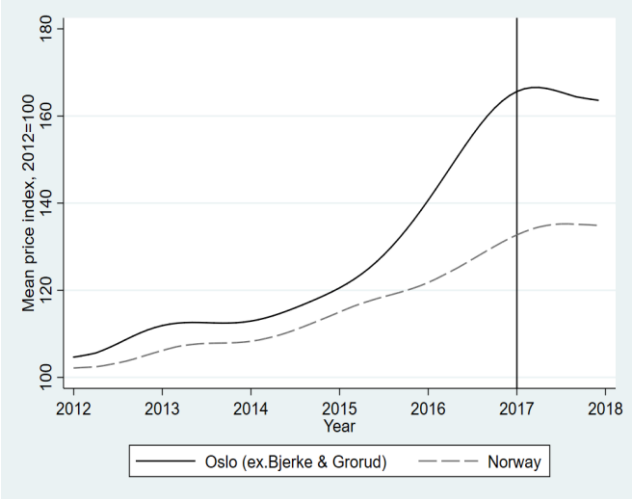

Figure 4.3.3: *The figure shows the average price index in Oslo excluding Bjerke and Grorud compared to the price index of Norway. The price index is normalized around 100 in 2012. The vertical line represents the implementation of the regulation.*

Figure 4.3.2 shows the abnormal price surge in Bjerke and Grorud versus the average price growth in Oslo. Removing these areas still yields a significant gap between Oslo and the control area, indicating that the assumption still is not likely to hold (see figure 4.3.3). Our results support this by having a significant DID estimate at 1 percent in 2016[11], and are presented in panel B table 3.

[11] In unreported regressions we also remove Stovner and Sondre Nordstrand in addition to Grorud and Bjerke in order to check the assumption in this case. These areas are subject to the highest standard deviation following Bjerke and Grorud in 2016. The parallel trend was still violated in 2016.

Changing our estimate for Oslo did not provide better results. Therefore, we decided to change our control group into an area more comparable to Oslo. According to a report released by the United Nations in 2014, more than half of humanity worldwide live within city lines. By 2016 approximately 81 percent of the Norwegian population lived within densely populated areas (SSB, 2016b). From this we found it plausible to use house prices from large cities in Norway as a control group. We included Trondheim, Stavanger, Kristiansand, Tromsø and Bergen.

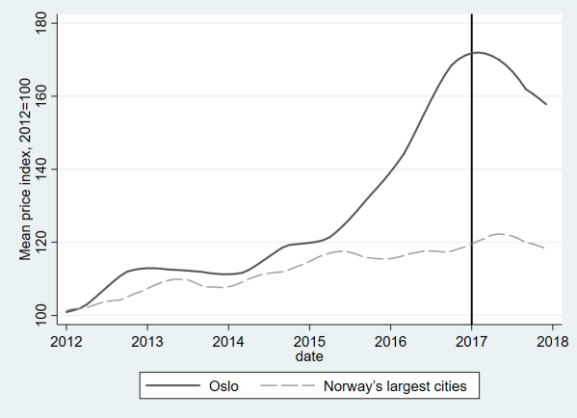

Figure 4.3.4: *The figure shows the average price index in Oslo compared to the index of Norway's largest cities. The price index is normalized around 100 in 2012. The vertical line represents the implementation of the regulation.*

Figure 4.3.4 shows that this approach provides similar results as earlier. The assumption is still not likely to be fulfilled and our analysis shows that the DD estimator is significant at all levels in 2016, and at 10 percent in 2015, see panel C table 3.

In the following step we proceed by focusing on counties surrounding Oslo, areas which has features similar to Oslo. Figure 4.3.5 shows that the counties close to Oslo, Buskerud[12] and Akershus[13], follow a trend with the closest similarities to Oslo.

[12] Buskerud is represented by an average price index of Drammen.
[13] Akershus is represented by an average price index consisting of Asker, Bærum, Follo and Romerike.

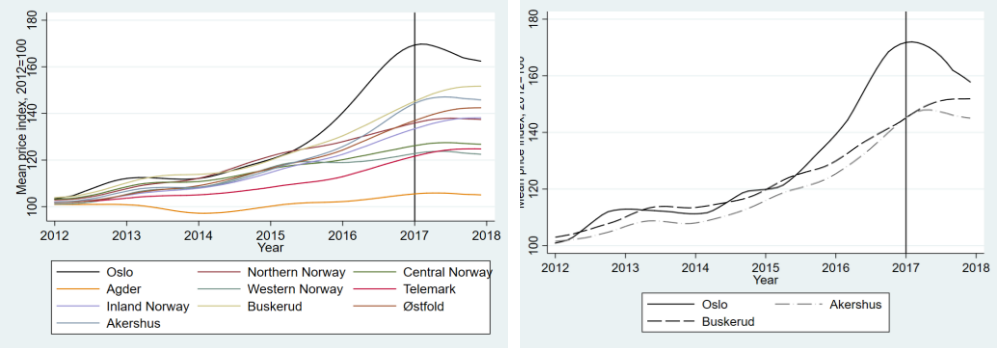

Figure 4.3.5: *The figure to the left shows the average price index in Oslo compared to price indices of Norway's counties. In order to make the graph easier to read we use some collective terms; Agder represents South- and West of Agder, Central Norway represent South- and West of Trøndelag, Western Norway represent Sogn and Fjordane, Møre and Romsdal, Hordaland and Rogaland, and Northern Norway represent Finnmark, Troms and Nordland. The price index is normalized around 100 in 2012. The vertical line represents the implementation of the regulation. The figure to the right shows the average price index in Oslo compared to price indices of Akershus and Buskerud. The price indices are normalized around 100 in 2012. The vertical line represents the implementation of the regulation.*

By studying the two trends, it is clear that they are more aligned then earlier control groups. This is supported by our analysis (panel D, table 3), although the DD estimator is still significant at 10 percent in 2015. When carefully studying the areas included in the control group we chose to omit Romerike from the sample as the area is subject to the highest standard deviation in 2015. The visual representation of the trend now seems acceptable, see figure 4.3.6. This is recognized further in our analysis by indicating that the parallel trend now is fulfilled, see table 3, panel E.

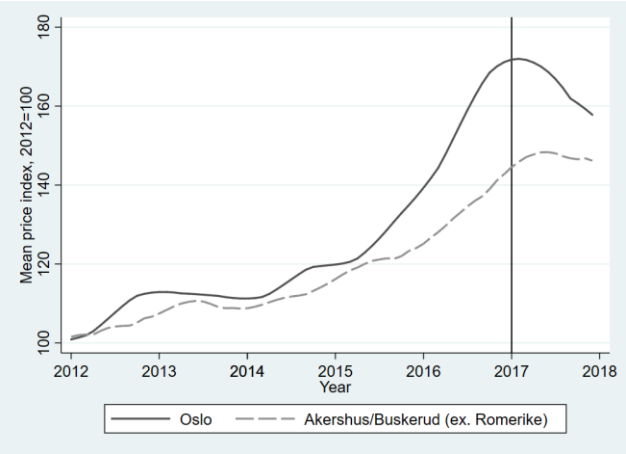

Figure 4.3.6 *The figure shows the average price index in Oslo compared to price indices of Akershus and Buskerud excluding Romerike. The vertical line represents the implementation of the regulation. The price indices are normalized around 100 in 2012.*

5.0 Results and Analysis

This section will present the results of our difference-in-difference estimation in regard to our research question:
How has the mortgage regulation implemented in 2017 affected house prices in Oslo?

At the beginning of 2017 the regulations in table 5.0 were implemented.

Interstate (Oslo) regulations	Domestic regulations
● Equity requirement of 40% when purchasing secondary homes (15% otherwise in the country) ● Banks may deviate from the regulations in 8% of total lending (10% in the rest of the country), alternatively 10 million NOK per quarter.	● Mortgage restriction at five times the gross annual income of customers. This entails the customer's total debt. ● If your equity < 40% you have to pay 2.5 % of the mortgage a year (previously < 30%) ● Loans without installments shall not exceed 60% of the appraised value of the housing (previously 70%)

Table 5.0: *The table summarizes the regulations that were implemented in 2017, both in Oslo and domestically. Source: Financial Supervisory Authority. (2015). Retningslinjer for forsvalig utlånspraksis for lån til boligformål.*

Earlier research seems to have a consensus that credit constraints indeed constrain households when purchasing a home, and so lowers their probability to do so (Haurin et al., 1996; Favara & Imbs, 2015). This is further linked to a lower house price market (Eerola & Määttänen, 2017). Secondly, the theory suggests that an

equity restriction might lower demand for housing, and thereby lower the prices (Benito, 2006). The argument is assumed to be persistent also when it comes to secondary homes. Accordingly, we believe that both of the regulations triggered the drop in house prices.

5.1 Description of analysis

The baseline linear regression that we test is equation 1. Including the variable *Oslo* control for permanent differences between the treatment and control group, while including the variable *post* will control for differences before and after the regulation in the control group, including the domestic regulations implemented nationwide. This way the variation that remains is the variations caused by the regulations imposed in Oslo, relative to the changes in the control area. This variation is captured by β_3, the DD estimate.

5.2 Results

To sum up the results presented in table 4, we find that the house prices in Oslo have declined significantly. This development can be allocated to the interstate regulations, which is in alignment with our initial expectations. The DD coefficient in column 2 in table 4, indicates that the difference between the house price index in Oslo compared to Norway has decreased by 1,44%, post regulation. Before the regulation the difference between the house price index in Oslo and Akershus and Buskerud were positive (1,33%), which means that the average growth in house price in Akershus and Buskerud surpassed the house price growth in Oslo. Overall, the Oslo house price index have experienced a 0.6% downfall, after controlling for common financial aspects of the areas (unemployment and income). These results provide evidence supporting our hypothesis although the economic significance seems rather small. A price growth decline of 0.6% results in 6000 NOK price decline for a 1 million NOK apartment, which is a trivial amount.

The DD coefficient is estimated from April 2017 due to the pre-qualification letter. Including the first 3 months in 2017 would yield a DD coefficient of -1.66%, and an overall price decrease in Oslo of 0.8%. This indicates that the price

fall in Oslo is higher than indicated by our analysis, but the 3-month period is removed in order to provide valid results.

When analyzing our data more closely we find that all of the areas of Oslo has experienced a price decrease in 2017, except Frogner and Ullern.

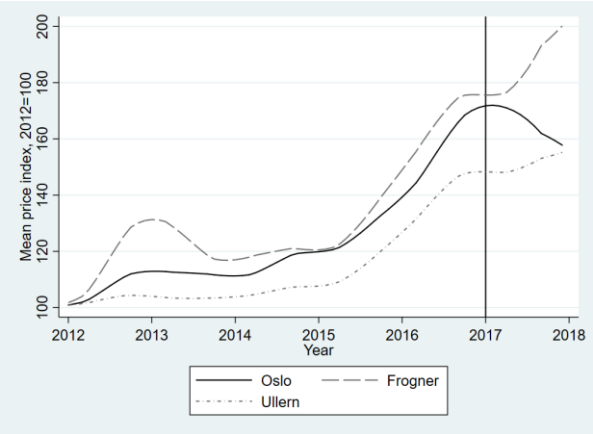

Figure 5.2.1: *The figure shows the average price index in Oslo compared to the index of Ullern and Frogner. The price index is normalized around 100 in 2012. The vertical line represents the implementation of the regulation.*

We find that Ullern and Frogner exhibit abnormal behavior relative to the rest of Oslo, post regulation. Generally, house prices in all Oslo areas start to fall approximately around January 1st, 2017. Frogner and Ullern are the only areas that keep rising. When including a dummy variable for each area we see that the impact of the regulation increases, the DD coefficient goes from -1.44% to -1.82% see column 1 in table 4. The coefficient for Frogner shows that this area had a price increase of 2,55% relative to the rest of the city, while Ullern were more stable with a coefficient amounting to 1.34%. When running the regression it is noticeable that the explanatory power rose in addition to the error term decreasing, indicating that removing them provides us with better results.

A possible explanation for these inequalities could be that it is an outcome following the initiation of the Tøyen-agreement in 2013. In the agreement Oslo municipality vouched to acquire a higher share of their municipal housing in the western area of Oslo (Boligbygg, 2017). In order to diversify their housing they would also sell off a large part of their existing housing base in the eastern part of Oslo, especially Tøyen. The agreement was initiated by several political parties in

order to improve the living and growing conditions in Tøyen. Following the agreement Oslo municipality has acquired hundreds of apartments in Oslo in 2016 and 2017, generally in the west of Oslo. In 2016, 40 percent of the municipality's total real-estate acquisition was based in Frogner. The following year the municipality represented six percent of the total sales in Frogner. In association with this process, the municipality has been subject to scrutiny in the media for buying residents at unfair prices. Allegations from several sources accused the district of buying the apartments far above market value (Haugen, 2016). Due to limited data we were not able to test the hypothesis of this being true, although it seems to be a plausible explanation for the prices in Frogner and Ullern to keep rising, post regulation. We therefore argue that excluding these areas from the treatment group would yield more accurate results. The DD estimate in this case would thereby indicate that the regulations in Oslo resulted in a drop in house prices by 1%.

5.2.1 Equity requirement

The evolvement of secondary homes in Oslo doubled in 2017, where the growth in number of units went from 651 in 2016 to 1276 in 2017 (Humberset, 2018). This contradicts our expectations as the mortgage requirement should have made it harder to obtain secondary homes. It is plausible that this growth would have been even stronger had the regulation not been implemented. Some of the growth could be caused by involuntary ownership. In 2017 homeowners experienced a price decrease and may therefore have struggled getting the asking appraisal. As a result the homeowner might postpone the auction. Another explanation could be that the strong price increase over the last years have increased homeowners' equity.

5.2.2 Debt constraint

In the last two-quarters of 2017 Bank of Norway displayed in their lending survey that the demand for new debt was lowered compared to 2016. This supports our initial beliefs. The regulation seem to have contributed to price decrease, implying that the lending constraint imposed on banks are representing the house price correction.

5.2.3 Falsification Test

In order to validate the model we need to make sure that the assumption of the model is fulfilled. An extensive run-through of the key assumption, parallel trend, were made in section 4. And the resulting evidence is presented in panel E in table 2. Further, specific to DD methodology are two additional assumptions which will be analyzed closer. This section will also employ a different data set for Oslo in order to validate our results.

5.2.4 Testing the Model Assumptions

It is important for the analysis to make sure that the independent variables are exogenous. This is called the assumption of exogeneity and involves no correlation between explanatory variables and the error term, i.e. endogeneity There are no ways to test empirically whether a variable is correlated with the error term, because the error term is unobservable (Roberts & Whited, 2013). A possible endogenous problem in our analysis would be that unobservable characteristics of different units make house prices behave differently. Examples of this would be square meters, balcony, refurbishment and age. By using a DD methodology we are avoiding this dilemma:

> The cross-sectional comparison avoids the problem of omitted trends by comparing two groups over time. The time series comparison avoids the problem of unobserved differences between two different groups of firms by looking at the same firms before and after the change. The double difference estimator, difference-in-differences (DD), combines these two estimators to take advantage of both estimators' strengths (Roberts & Whited, 2013, p. 33).

The only setting where this might still be a problem is if unobservable attributes change over time such that this trend would correlate with the treatment group. This feature will be evaluated using transaction-level data in section 5.

Further, specific to the DD methodology is the assumption that in the pretreatment period the treatment had no effect on the pretreatment population (Lechner, 2011). For instance if the pretreatment group accelerate their purchasing process because they know that the regulation will be implemented. Figure 5.2.2 shows the price

index development following the announcement of the regulation. It is evident that the house price index kept rising post announcement. It is important to note that it is difficult to attribute this to the announcement itself, or other factors being in place pre-announcement as well. Acquiring a home is often a tedious and time-consuming process, and some of the biggest decision a person can make during a lifetime. Accelerating such a process may not be feasible.

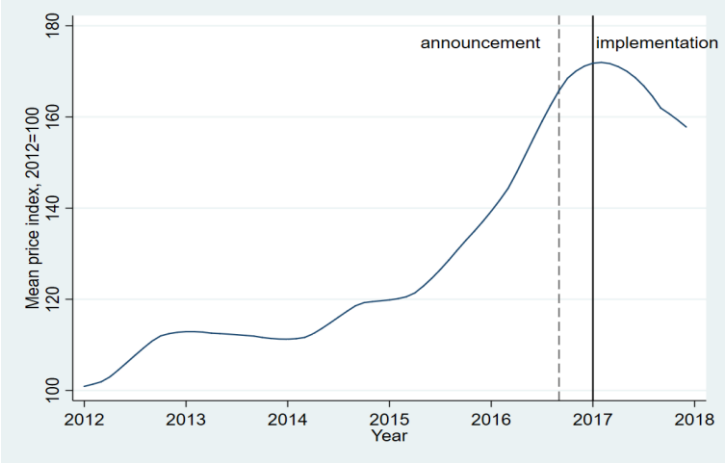

Figure 5.2.2: *The figure shows the average price index in Oslo. The vertical line represents the implementation of the regulation and the dashed line represents the announcement. The price index is normalized around 100 in 2012.*

5.2.5 Alternative treatment

A widespread method used to validate the estimates using a DD is by implementing an alternative control group in order to show that results are still in place. Examples of papers using this extended analysis are Agarwal and Karapetyan (2016), and Lechner (2011). When verifying the parallel trend in section 4 it was made clear that this approach would be difficult in our case due to the Norwegian demography making the areas' comparability limited. We did however verify our results by changing the data on the treatment group. Instead of using OBOS data, which includes all transfers of ownership in OBOS cooperatives, we used Real-estate Norway's dataset including approximately 70 percent of all traded units each year, advertised on Finn.no (Real Estate Norway, 2018b). By doing this our treatment group represents a wider range of houses, for instance apartments, houses, cooperatives etc., which we believe would further verify our results and provide more general results. Cooperatives, as represented by the OBOS data, may not be as affected by the 40 percent equity restriction on

secondary homes, as it is not allowed to rent out an OBOS apartment for the first 12 months of ownership. Thereby, such houses may not be as attractive for investors looking to buy a secondary home. Performing our analysis with a broader dataset might therefore yield a better picture of the effect.

Using Real-Estate Norway's dataset still show significant results for the DD coefficient, although slightly lower compared to the OBOS dataset (-1.47% versus -1.44%). The actual change in Oslo was higher using this dataset, -1.14% versus -0.6%. This indicates that when looking at all housing types in Oslo, the decrease in house prices was higher compared to solely cooperatives. As mentioned above the 40 percent equity restriction on secondary homes did not seem to dilute the investor based acquisitions, most likely due to the equity growth homeowners have experienced in the last years. These results contradict this by showing that a broader specter of homes experienced a more significant house price decrease than cooperatives alone. It also indicates that cooperatives in fact are less attractive to investors.

5.2.6 Parallel trend

Falsification tests were also performed regarding the parallel trend, see table 5.2, indicating that the two areas follow a trend which validates this extended analysis. Using Real Estate Norway's dataset does yield some shortcomings. A definition of the proportion of units does not exist, and therefore it is difficult to make precise inferences from this analyses as it contains units that may not be comparable, for example a house may have different characteristics than an apartment. One could also argue that these results are biased because our control group only consists of cooperatives, thereby not controlling for the time trends that self-owned units and houses may contain. Comparing the two datasets may therefore not yield accurate results.

Variables	Coefficient	R-Squared Root MSE
2017	-0.0147*** (0.0041)	R^2: 0.335 MSE: 0.0139
2016	0.0026 (0.0053)	R^2:0.300 MSE: 0.0142
2015	-0.340 (0.6985)	R^2: 0.298 MSE: 0.0141
2014	0.0041 (0.0030)	R^2: 0.2981 MSE: 0.0142
2013	-0.0123 (0.0037)	R^2: 0.278 MSE: 0.0142

Table 5.2: *The table summarizes our results when using Real-estate Norway's data of Oslo. Significance level at 1 percent is indicated by ***, 5 percent at **, and 10 percent at *. Robust standard errors are reported in parentheses. The number of observations is 978.*

5.3 Transaction-Level Data in Oslo

By using transaction-level data solely in Oslo, containing both cooperatives and self-owned units we are able to analyze the regulatory effect on cooperatives compared to self-owned units. On the one hand, the regulation on secondary homes seems to directly affect only self-owned units, on the other, a marginal homebuyer will still compare a cooperative unit's price with a potentially decreased price of a self-owned unit. A marginal investor do not care about cooperatives because it is prohibited to rent such an apartment without the coop-owner having lived there themselves for a minimum of 1 year[14]. This feature makes it plausible to believe that coops are less attractive for real-estate investors. Thereby, only looking at coops might cause biased results. Using coops as a control group enables us to see whether they differentiate from self-owned units when it comes to the regulations.

In section 3.1 it is specified that the DD estimator is viewed as both an unbiased and consistent estimator of the causal effect, by assuming randomly assigned treatment when using a geographically different control area. This assumption is not likely to hold in reality because the regulations imposed in 2017 were

[14] See law of cooperatives ("Burettslagslova") § 5-5 at www. lovdata.no. After having lived there yourself for one year there is a maximum limit for rental period of 3 years.

implemented due to the abnormal price increase that occurred, especially in Oslo. By using transaction-level data we hope to restore randomness to our sample by controlling for observable characteristics (size, area and floor) as well as unobservable features by using monthly fixed effects. For instance, apartments in Akershus and Buskerud could be smaller in size than in Oslo, thereby biasing our DD estimate upwards. By this we hope to restore randomness to our sample.

5.3.1 Data

The complete dataset consist of 559773 observations and 38 variables gathered from Grunnboken, provided by Kartverket. The variables consisted of the transaction date, transaction number, price, date built, floor, square meter etc. After cleaning the data, i.e. removing everything that is not characterized as an apartment (i.e. cabins, garage, church etc.) we are left with 134631 observations. We then removed the duplicates in the dataset (when more than one person bought the same apartment, the transaction were recorded multiple times). Finally, data prior to 2006 were removed as transaction data on cooperatives only exist from 2006 and forward. The finished dataset consists of 40998 observations. Summary statistics of the dataset is presented in table 5. The average price of self-owned units decreases post regulation, from 3.98 (million NOK) to 3.60 (million NOK) which is what is expected. Coops average price increase post regulation. The peculiar feature could be connected with the age of buildings decreasing post regulation. During the strong price increase in 2016 it was stated that one of the reasons was the slow development of new apartments in the capital compared to the population growth (Lorch-Falch, 2016). As a response, a building spree was initiated in Oslo to help restrain the abnormal price increase. This caused a number of new apartments to emerge, and new apartments are commonly more expensive than older ones. The two units differ by size and age, cooperatives are on average 17 square meters bigger than self-owned units, and are younger.

In figure 2 we provide an overview representing the proportion of self-owned units across areas in Norway, before and after the regulation. The proportion remained constant over time.

5.3.2 Results

We hypothesize that self-owned units in Oslo have experienced a greater price decrease relative to cooperatives in Oslo because the 40 percent equity requirement becomes vastly more applicable here. The baseline specification that we test is:

$$P_i = \propto + \beta_1 Selfown_i + \beta_2 * Post + \beta_3 (Selfown_i * Post) + W_i \varphi + Z_i \psi + \varepsilon_i \quad (2)$$

where $Selfown_i$ is the apartment price associated with self-owned unit i, $Post$ is a dummy that takes a value if 1 if the transaction was completed after March 2017 (avoiding the effect of the pre-qualification letters from the year before), $(Selfown_i * Post)$ is the DD estimate which is equal to one if the transaction finds place after March 2017, and the unit sold is a self-owned unit. W_i is a vector of controls including monthly fixed effects, Z_i is the unit's hedonic characteristics (floor, age of building, square meter, location and number of rooms).

Table 6 summarize our results when fitting data to equation 2. When examining how the house prices of self-owned units are affected post regulation relative to cooperatives, we find that the price decreased. The difference in price between the two units decrease by 19 percentage point, indicating that our hypothesis is true. Self-owned units did have a larger decrease in price relative to cooperatives after the event. As mentioned, evidence shows that the number of secondary homes increased post regulation, despite the equity requirement on secondary homes. Our results, however, indicate that the regulation did have an effect by lowering the price on self-owned units more significant.

5.3.3 Omitted Variable Bias

An omitted variable bias occurs when a variable that should be included in the vector of explanatory variables of a regression, is not included (Roberts & Whited, 2013). This may bias our estimated coefficient if the excluded variable is correlated with any of the included explanatory variables. When analyzing the change in house prices debt would be a valuable variable to include. As mentioned in the introduction Norway has a large share of homeowners compared to most other nations. Buying a home is usually associated with a home mortgage, and according to SSB (2015b) most households had a mortgage of 1 million kroner. They further report that the highest amount of mortgages are found in the households of the capital. A large variation in housing prices could therefore be explained by the value of debt, which will fluctuate with the mortgage interest rate. The price of cooperatives is also often involved with a high amount of common debt[15], and when the mortgage rate changes so will the value of coop debt, generally affecting the price of the cooperatives. Information about each unit debt level was not available, and therefore not possible to include as an explanatory variable.

In order to outline how severe this concern is we analyzed the financial statements of 100 cooperatives to sketch their mortgage rate development in 2007, 2008, 2016 and 2017. Looking at 2007 and 2008 is motivated by the fact that during the financial crisis many coops could have refinanced their common debt. Our results are presented in table 5.4, alongside the average private mortgage rate. It is recognized that the average interest rates change over these years, increasing from 2007 to 2008, and then decreasing from 2016 to 2017. This analysis shows that the interest rates of coops are very much aligned with those associated with private mortgages over the period. The implication will be that the value of debt will change for both units. From this we conclude that the effect of debt on our analysis is an innocuous concern which does not bias our results.

[15] Coops in Norway usually borrow significant amount of debt at the time when they are built. The value of this debt will change when the mortgage rate change, which in turn will change the value of the coop.

Year	Cooperatives Average Mortgage Rates	Average Private Mortgage Rates
2007	5.54%	5.55%
2008	6.66%	7.04%
2016	3.00%	2.55%
2017	2.43%	2.53%

Table 5.3: *Average mortgage rates for both cooperatives and individuals in 2007-2008 and 2016-2017. The cooperative average mortgage rate is gathered from a careful analysis of 100 cooperatives' financial statements in the analysis. The financial statements of the cooperatives were obtained from Brønnøysundregisteret (www.brreg.no). The average private mortgage rates are gathered from SSB (2018). (www.ssb.no/en/bank-og-finansmarked/statistikk/renter).*

5.4 Robustness test

In section 3 we mention that by using the difference-in-difference methodology we control for observable and unobservable characteristics. In settings where these change over time so that they correlate with the treatment group, this could result in biased DD estimates. For example, if high price coops decrease in size post-event, then this might bias our DD estimate downward. By using the transaction level data we interact the Post dummy with the hedonic characteristics of the units (floor, square meter, age, rooms) to account for varying observables over time that may be correlated with Post. By including the monthly fixed effects we are also accounting for time-varying trends that is unobservable. The results are presented in column 4 in table 6, and does not change our initial results.

6.0 Conclusion

6.1 Conclusion

Norway has experienced a great house price increase over the last decade. Alongside this development, the government has initiated measures trying to restrain the growth from accelerating further. The International Monetary fund has stated that the house price development might threaten the financial stability of Norway and is therefore essential to focus on (Barstad et al., 2016).

Understanding how regulatory actions might aid is essential for future regulatory measures.

We hypothesized that the regulatory changes made in 2017 had a negative effect on the Oslo house prices. In our initial analysis we found evidence supporting this hypothesis. The results were consistent using both a dataset containing only cooperatives and a dataset containing 70 percent of all units being sold in Oslo. When elaborating our study we believed that self-owned units would show a higher negative impact, and by that state that these units are more attractive for investors, the group believed to be significantly exposed to the 40 percent equity requirement on secondary homes. Section 5 provides concluding evidence of this by utilizing a transaction level data where cooperatives are the control group.

Our results provide important insights regarding the Norwegian housing market, particularly in Oslo.

6.2 Suggestions for further research

The mortgage regulation, which is the subject of study in this thesis, are still applicable when writing this paper and was extended from 01.07.18 to 31.12.19 (it originally expired 30.06.18). Apparent in our paper is that we find these legislative measures to have an effect on the house prices in Oslo. After having a slowdown in house prices during 2017, the prices have accelerated the last couple of months and showed a strong development through the first half of 2018. This surge might be similar to the conditions present in 2016. In April 2018 the prices were the highest in 10 years (Borchgrevink, 2018). This development is unexpected because the limitations which were found to restrain the house prices are still in duration. We believe it would be highly interesting to research the mechanisms causing this progression.

7. Bibliography

Agarwal, S., Driscoll, J. C., & Laibson, D. I. (2013). Optimal Mortgage Refinancing: A Closed-Form Solution. *Journal of Money, Credit and Banking*, *45*(4), 591-622.

Agarwal, S., & Karapetyan, A., Salience and Mispricing: Homebuyers' Housing Decisions (November 1, 2016). *Norges Bank* Working Paper 21.

Bank of Norway. (2017). Bank of Norway Survey on Bank Lending. Obtained 04.06.2018 from: https://www.norges-bank.no/en/Published/Publications/Norges-Banks-Survey-of-Bank-Lending/q3_2017-survey-of-bank-lending/

Bank of Norway (2011). Pengepolitikken og sammenhenger i Norsk økonomi. Obtained 12.01.18 from http://www.norges-bank.no/Publisert/Foredrag-og-taler/2011/05092011-CME/

Barstad, S., Dahl, C. A., Enge, C., & Hveem, E. B. (2016, July 5th). IMF: -Det Norske boligmarkedet er kraftig overpriset. *Aftenposten.* Obtained 20.07.18 from https://www.aftenposten.no/okonomi/i/bOX2B/IMF--Det-norske-boligmarkedet -er-kraftig-overpriset

Benito, A. (2006). The down-payment constraint and UK housing market: does the theory fit the facts? *Journal of Housing Economics*, *15*(1), 1-20.

Bertrand, M., & Mullainathan, S. (2003). Enjoying the quiet life? Corporate governance and managerial preferences. *Journal of Political Economy 111*, 1043-1075.

Bjørnland, H. C., & Jacobsen, D. H. (2010). The role of house prices in the monetary policy transmission mechanism in small open economies. *Journal of financial stability*, 6(4), 218-229.

Boligbygg. (2017). Årsrapport Boligbygg 2017. Obtained 30.04.18 from https://issuu.com/boligbygg/docs/boligbygg-a_rsrapport-2017-web-link

Borchgrevink P. S. DNB Eiendom. (2018). Boligprisene øker: Sterkeste april-veksten på ti år. Obtained 04.05.18 from: https://www.dnbeiendom.no/altombolig/kjop-og-salg/boligprisstatistikk/

Business Insider. 2012. "This Quiet American City Has The Highest Per-Capita GDP In The World". Obtained 06.01.2018 from http://www.businessinsider.com/this-quiet-american-city-has-the-highest-percapita-gdp-in-the-world-2012-1

Caplin, A., Tracy, J., Chan, S., Freeman, C., & Tracy, J. I. (1997). *Housing partnerships: A new approach to a market at a crossroads*. Mit Press.

Card, D. (1990). The impact of the Mariel boatlift on the Miami labor market. *ILR Review*, *43*(2), 245-257.

Card, D., & Krueger, A. B. (1994). *The economic return to school quality: A partial survey* (No. 713).

Case, K. E. & Shiller, R. J. (1989). "The Efficiency of the Market for Single Family Homes." *The American Economic Review 79* (1): 125-137.

Eerola, E., & Määttänen, N. (2017). Borrowing constraints and housing market liquidity. *Review of Economic Dynamics*.

Real Estate Norway. (2018a). Den norske boligmodellen. Retrieved 12.01.18 from http://eiendomnorge.no/hovedsaker/den-norske-boligmodellen/

Real Estate Norway. (2018b). Eiendom Norges boligprisstatistikk Februar 2018. Obtained 04.04.18 from http://eiendomnorge.no/wp-content/uploads/2018/03/eiendomnorge.no-februar-2018-boligprisstatistikk-februar-2018-02-2018-03-01_14-12-57_ 006214. pdf

Favara, G., & Imbs, J. (2015). Credit supply and the price of housing. *American Economic Review* 105(3), 958-992.

FSA (Financial Supervisory Authority). (2016). Finansielle utviklingstrekk 2016. Obtained 12.01.18 from https://www.finanstilsynet.no/nyhetsarkiv/press emeldinger/2016/ finansielle-utviklingstrekk-2016/

FSA (Financial Supervisory Authority). (2009). The Financial Market in Norway 2008; Risk Outlook. Obtained 10.08.18 from https://www.finanstilsynet.no/contentassets/e2c7f82b55da41ffa24385245706371b/risk_outlook_2008.pdf

Fædrelandsvennen. (2017). Vi har et supersunt boligmarked i byen. Obtained 03.06.18 from https://www.fvn.no/nyheter/okonomi/i/egbvQ/-Vi-har-et-supersunt-boligmarked-i-byen

Garvey, G. T., & Hanka, R., G. (1999), Capital structure and corporate control: The effect of antitakeover statutes on firm leverage, *Journal of Finance 54*, 519-546.

Gjerstad, L. (2016, February 9th). Her er de høyeste boligprisene i Norge nå. *Aftenposten*. Obtained 12.01.18 from https://www.aftenposten.no/bolig/ Her-er-det-de-hoyeste-boligprisene-i-Norge-na-9097b.html

Global Property. (2018). Norway's housing market is slowing sharply. Obtained 10.04.18 from https://www.globalpropertyguide.com/Europe /Norway/Price-History

Haugen, S. (2016, December 21st). Har kjøpt 103 leiligheter i Norges dyreste bydel. *Dagbladet.* Obtained 20.04.18 from https://www.dagbladet.no/nyheter /har-kjopt-103-leiligheter-i-norges-dyreste-bydel/66564296

Haurin, D. R., Hendershott, P. H., & Wachter, S. M. (1996). Borrowing constraints and the tenure choice of young households (No. w5630). *National bureau of economic research*.

Hendershott, P. H. (1987). Home Ownership and Real House Prices: Sources

of Change, 1965-85. *National Bureau of Economic Research*. Retrieved. 12.01.18 from http://www.nber.org.ezproxy.library.bi.no/papers/w2245.pdf

Humberset,. K. (2018, March 13th). Flere eier to boliger nå enn tidligere. *Aftenposten.* Obtained 04.06.18 from: https://www.aftenposten.no/bolig/Flere-eier-to-boliger-na-enn-tidligere- Det-skjer-til-tross-for-boliglansforskriften-11723b.html

Jeon, S. (2004). Estimating the Labour Supply Responses of Married Women Using a Canadian Tax Reform. Retrieved 03.06.18 from https://economics.ca//2004/papers/0377.pdf

Larsen, E. R. (2018). Can monetary policy revive the housing market in a crisis? Evidence from high-resolution data on Norwegian transactions. *Journal of Housing Economics*.

Larsen, E. R., & Sommervoll, D. E. (2003). Towards the sky or off the cliff? A catalogue of explanations of rising prices of housing, *SSB*, 2003/64

Larsen, E. R. & Sommervoll, D. E. (2004). "Rising Inequality of Housing: Evidence from Segmented House Price Indices." *Housing, Theory and Society 21* (2): 77-88.

Larsen, E. R., & Weum, S. (2008). Testing the efficiency of the Norwegian housing market. *Journal of Urban Economics*, 64(2), 510-517.

Lechner, M. (2011). The estimation of causal effects by difference-in-difference methods. *Foundations and Trends® in Econometrics*, *4*(3), 165-224.

Linneman, P., & Wachter, S. (1989). The impacts of borrowing constraints on homeownership. *Real Estate Economics*, 17(4), 389-402.

Lorch-Falch, S. (2016, August 18th). Så mange Oslo-boliger må bygges for å løse boligmangelen. *E24.* Obtained 18.07.18 from https://e24.no/privat/raymond-johansen/saa-mange-oslo-boliger-maa-bygges-for-aa-loese-boligmangelen/23764214

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *Journal of economic perspectives*, *17*(1), 59-82.

Mian, A., & Sufi, A. 2009. The consequences of mortgage credit expansion: evidence from U.S. mortgage default crisis. *Q. J. Econ* 124(4), 1449-1496.

NEF (The Norwegian Association of Real Estate). (2016). Obtained 12.01.18 from: http://www.nef.no/nyheter/statistikk-651-flere-sekundaerboliger-oslo-2016/

Murtin, F., & d'Ercole, M. M. (2015). *Household wealth inequality across OECD countries: new OECD evidence.* OECD. Obtained 01.05.2018 from https://www.oecd.org/sdd/household-wealth-inequality-across-OECD-countries-OECDSB21.pdf

Olsen, Ø. (2017). *Pengepolitikkens formål og muligheter.* The Bank of Norway. Obtained 03.05.2018 from https://www.norges-bank.no/Publisert/Foredrag-og-taler/2017/2017-10-26-cme/

Roberts, M. R., & Whited, T. M. (2013). Endogeneity in empirical corporate finance. In *Handbook of the Economics of Finance* (Vol. 2, pp. 493-572). Elsevier

Sandberg, T. (2016, October 11th). Vanlig å ikke bo i egen bolig. *Dagsavisen.* Obtained 10.08.18 from https://www.dagsavisen.no/innenriks/vanlig-a-ikke-bo-i-egen-bolig-1.789877

Skatteetaten. (2018). *Salg av bolig og fast eiendom.* Obtained 10.06.2018 from http://www.skatteetaten.no/no/person/selvangivelse/tema-og-fradrag/bolig/kjop-og-salg/salg-mv-av-fast-eiendom/?chapter=3833

SSB (Statistics Norway). (2017). *Boligprisstatistikk 2017*. Obtained 10.01.18 from https://www.ssb.no/befolkning/statistikker/beftett

SSB (Statistics Norway). (2016a). *80% eier egen bolig i Norge*. Obtained 09.01.18 https://www.ssb.no/bygg-bolig-og-eiendom/statistikker/boforhold/aar/2016-09 -29

SSB (Statistics Norway). (2016b). *Befolkning og areal i tettsteder*. Obtained 03.06.18 from https://www.ssb.no/befolkning/statistikker/beftett/aar/2016-12-06

SSB (Statistics Norway). (2015a). *Hvorfor ulike arbeidsledighetstall?* Obtained 15.01.18 from https://www.ssb.no/arbeid-og-lonn/artikler-og-publikasjoner/hvorfor-ulike-arbeidsledighetstall--236723

SSB (Statistics Norway). (2015b). *Boforhold, levekårsundersøkelsen, 2015*. Obtained 20.07.18 from https://www.ssb.no/bygg-bolig-og-eiendom/statistikker/bo/hvert-3-aar/2015-11-25

SSB (Statistics Norway). (2012). *Households' income and wealth, 2012*. Obtained 15.01.18 from https://www.ssb.no/en/ifformue

Steigum, E. (2010). Norsk økonomi etter 1980–fra krise til suksess. Obtained 10.01.2018 from https://brage.bibsys.no/xmlui/handle/11250/95159

Stock, J. H., & Watson, M. W. (2014). *Introduction to econometrics: Global edition*. Boston, MA: Pearson Education.

Stuart, E. A., Huskamp, H. A., Duckworth, K., Simmons, J., Song, Z., Chernew, M. E., & Barry, C. L. (2014). Using propensity scores in difference-in-differences models to estimate the effects of a policy change. *Health Services and Outcomes Research Methodology*, 14(4), 166-182.

Tennøy, A. 2002."Town councils and urban districts as active participants in the housing market". *Norwegian Institute for Urban and Regional Research (NIBR) report* 2002:07.

Thomson Reuters, (2017). "Norway's economy vulnerable to house prices". Obtained 10.01.18 from https://www.reuters.com/article/norway-banks-

regulator/update-2-norways-economy-vulnerable-to-house-prices-bank-regulator-idUSL8N1NZ2AI

Zorn, P. M. (1989). Mobility-Tenure Decisions and Financial Credit: Do Mortgage Qualification Requirements Constrain Homeownership? *Real Estate Economics*, 17(1), 1-16

8 Appendix

Table 1: Summary of legislative measures regarding mortgages

Guidelines were first put in place by the Financial Supervisory Authority (FSA) in 2010. The mortgage regulations put in place in recent time is a development of these.

Date	Norway	Oslo
2017	• Expired 30.06.18. The mortgage regulations from 2015 were extended with additions: • Loans exceeding five times the gross annual income of customers will not be granted. • Installment free loan cannot exceed 60 percent of the value of the property	• The mortgage regulation had an additional requirement for Oslo. • 40 percent equity requirement when purchasing a secondary home (15 percent in the rest of the country) • Financial institutions may deviate from the requirements for up to 8 percent of the value of loans granted each year or 10 million per quarter.
2015	Expired 31.12.16. Mortgage regulations. • The regulations stipulate that a financial institution may deviate from the requirements for up to 10 percent of the value of loans granted each quarter. • Installment free loan cannot exceed 70 percent of the value of the property.	
2010	Guidelines for sound lending practices were laid down by the Financial Supervisory Authority (FSA): • Customers should endure a 5 percent interest rate increase • The mortgage shall not exceed 85 percent of the sound valuation of the property. • Installment free loan shall not exceed 70 percent of the value of the property.	

Sources: Act of 10th of April, 2015. Forskrift om krav til nye utlån med pant i bolig (boliglånsforksiften). www.regjeringen.no. Financial Supervisory Authority of Norway, (2010), Retningslinjer for forsvarlig utlånspraksis for lån til boligformål.

Table 2: Summary statistics[16]

Panel A: Summary statistics Oslo - Norway

	Oslo					Norway				
Variables	Obs	Mean	s.d	Min	Max	Obs	Mean	s.d	Min	Max
Price Index	1080	130.61	25.02	100	208.87	72	116.84	11.46	100	137.93
GDP	1080	604457.8	11760.75	581237.1	642546.3	72	604457.8	11760.75	581237.1	642546.3
Unemployment	1080	1296.04	435.52	593.07	2310.31	72	74877.14	7662.72	60503	93284
Income	1080	195.6465	20.84	159.97	231.31	72	143.55	6.28	132.20	153.23

Panel B: Summary statistics Oslo – Cities of Norway

	Oslo					Cities of Norway				
Variables	Obs	Mean	s.d	Min	Max	Obs	Mean	s.d	Min	Max
Price Index	1080	130.61	25.02	100	208.87	72	112.85	6.14	100	123.32
GDP	1080	604457.8	11760.75	581237.1	642546.3	72	604457.8	11760.75	581237.1	642546.3
Unemployment	1080	1296.04	435.52	593.07	2310.31	72	74877.14	7662.72	60503	93284
Income	1080	195.6465	20.84	159.97	231.31	72	143.55	6.28	132.20	153.23

Panel C: Summary statistics Oslo – Akershus and Buskerud

	Oslo					Akershus and Buskerud				
Variables	Obs	Mean	s.d	Min	Max	Obs	Mean	s.d	Min	Max
Price Index	1080	130.61	25.02	100	208.87	288	121.44	15.99	99.89	155.66
GDP	1080	604457.8	11760.75	581237.1	642546.3	288	604457.8	11760.75	581237.1	642546.3
Unemployment	1080	1296.04	435.52	593.07	2310.31	288	873.95	559.67	258.38	1895.94
Income	1080	195.6465	20.84	159.97	231.31	288	174	7.30	160	186.23

[16] The unemployment rate is presented in number of people due to data limitation

Panel D: Summary statistics of Oslo

	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Alna	Price Index	72	132.39	24.62	100	174.96
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	2128.66	115.05	1996.97	2289.22
	Income	72	195.61	20.96	160.04	231.17
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Bjerke	Price Index	72	131.32	29.30	100	190.91
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	869.16	98.36	771.32	1028.06
	Income	72	195.63	20.97	160.04	231.20
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Frogner	Price Index	72	140.16	28.06	100	208.87
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1514.16	90.60	1401.27	1688.75
	Income	72	195.66	21.00	160.02	231.26
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Gamle Oslo	Price Index	72	133.38	25.48	100	179.52
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1974.33	239.57	1680.71	2310.31
	Income	72	195.64	20.98	160.03	231.23
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Grorud	Price Index	72	133.31	29.62	100	204.18
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	922.16	77.04	777.81	1039.36
	Income	72	195.61	20.96	160.05	231.18
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Grunerlokka	Price Index	72	135.73	25.88	100	179.98
	GDP	72	604457.8	11815.84	581237.1	642546.3

	Unemployment	72	1723.33	126.19	1525.23	1945.27
	Income	72	195.62	20.98	160.02	231.20
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Nordre Aker	Price Index	72	123.28	19.33	100	160.62
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1014.66	59.19	948.83	1130.25
	Income	72	195.69	20.98	160.07	231.28
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Nordstrand	Price Index	72	126.75	22.01	100	166.24
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1260.83	76.32	1160.49	1387.63
	Income	72	195.70	20.98	160.09	231.29
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Østensjø	Price Index	72	129.24	22.70	100	169.73
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1455.83	121.43	1163.98	1577.89
	Income	72	195.68	20.97	160.08	231.26
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Sagene	Price Index	72	140.17	29.51	100	192.67
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1530.16	152.33	1100.68	1678.15
	Income	72	195.65	20.98	160.04	231.23
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Søndre Nordstrand	Price Index	72	132.29	24.63	100	181.03
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1418.66	209.55	1170.17	1745.74
	Income	72	195.60	20.96	160.03	231.16
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**

St. Hanshaugen	Price Index	72	125.50	20.64	100	161.41
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	1143.33	47.71	1045.81	1211.41
	Income	72	195.56	20.97	159.97	231.14
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Stovner	Price Index	72	133.78	22.99	100	177.79
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	965	120.35	811.21	1147.98
	Income	72	195.59	20.95	160.04	231.15
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Ullern	Price Index	72	119.50	19.63	100	157.77
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	634	31.11	593.07	711.50
	Income	72	195.67	20.99	160.05	231.27
	Variables	**Obs**	**Mean**	**s.d**	**Min**	**Max**
Vestre Aker	Price Index	72	122.38	18.45	100	156.62
	GDP	72	604457.8	11815.84	581237.1	642546.3
	Unemployment	72	886.33	78.14	780.79	982.25
	Income	72	195.701	21.00	160.05	231.31

Figure 1: Graphical representation of the definition of the Norway variable

The orange area represents places where we had data on the entire county. The red areas represent where we did not have county-level data. Here we used municipality level data to represent the county: West of Agder is represented by the city of Kristiansand, Akershus County is represented by Follo, Asker, Bærum and Romerike, Østfold county is represented by Sarpsborg and Fredrikstad, and Drammen represents the county of Buskerud. The grey area represents East of Agder where we did not have any data.

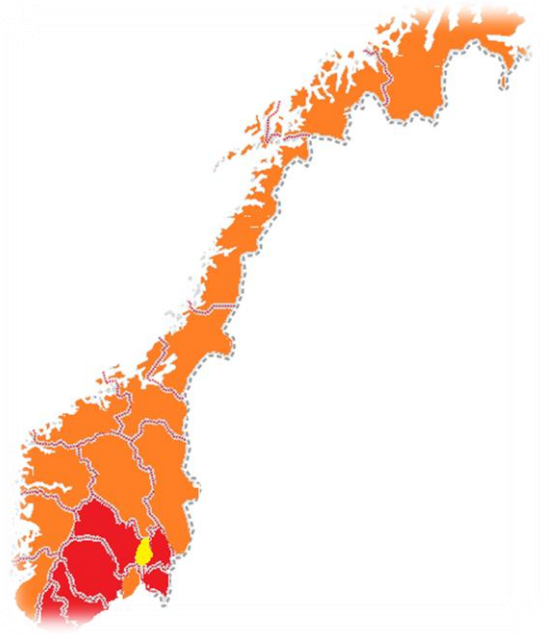

Table 3: Parallel trend

The panels summarize our results. Significance level at 1 percent is indicated by ***, 5 percent at **, and 10 percent at *. The dependent variable is the 1st difference of the house price index. The panels show regression results in the generalized model, including the interaction of Oslo (treatment) with 2013, 2014, 2015, 2016 and 2017. Time fixed effects are not reported. The robust standard errors are reported in the parentheses.

Panel A: Parallel trend Norway

Variables	Coefficient	R^2	Root MSE
*DD (2017*Oslo)*	-2.582*** (0.5814)	0.484	1.743
*DD (2016*Oslo)*	2.009*** (0.0093)	0.482	1.746
*DD (2015*Oslo)*	0.815 (0.6403)	0.477	1.754
*DD (2014*Oslo)*	-0.109 (0.3931)	0.476	1.756
*DD (2013*Oslo)*	-0.671 (0.5348)	0.476	1.755
			Observations 1278

Panel B: Parallel trend: Oslo ex. Bjerke and Grorud - Norway

Variables	Coefficient	R^2	Root MSE
*DD (2017*Oslo)*	-2.284*** (0.5824)	0.503	1.713
*DD (2016*Oslo)*	-0.266 (0.4667)	0.497	1.722
*DD (2015*Oslo)*	0.114 (0.5629)	0.497	1.722
*DD (2014*Oslo)*	0.114 (0.4626)	0.497	1.723
*DD (2013*Oslo)*	-0.583 (0.5231)	0.497	1.722
			Observations 1136

Panel C: Parallel trend cities of Norway

Variables	Coefficient	R^2	Root MSE
*DD (2017*Oslo)*	-2.582*** (0.5001)	0.484	1.740
*DD (2016*Oslo)*	2.574*** (0.5581)	0.485	1.737
*DD (2015*Oslo)*	1.053* (0.5629)	0.477	1.751
*DD (2014*Oslo)*	-0.383 (0.4104)	0.476	1.753
*DD (2013*Oslo)*	-0.848 (0.5466)	0.476	1.752
			Observations 1136

Panel D: Parallel trend Oslo – Akershus and Buskerud

Variables	Coefficient	R^2	Root MSE
*DD (2017*Oslo)*	-2.0896*** (0.4340)	0.410	1.839
*DD (2016*Oslo)*	0.314 (0.6049)	0.394	1.863
*DD (2015*Oslo)*	0.723* (0.3875)	0.396	1.860
*DD (2014*Oslo)*	0.312 (0.2567)	0.395	1.862
*DD (2013*Oslo)*	-0.093 (0.3367)	0.394	1.863
			Observations 1349

Panel E: Parallel trend Oslo – Akershus and Buskerud (excluding Romerike)

Variables	Coefficient	R^2	Root MSE
*DD (2017*Oslo)*	-2.299*** (0.4813)	0.427	1.825
*DD (2016*Oslo)*	0.296 (0.6498)	0.412	1.849
*DD (2015*Oslo)*	0.698 (0.4627)	0.413	1.847
*DD (2014*Oslo)*	0.283 (0.3274)	0.412	1.849
*DD (2013*Oslo)*	0.0806 (0.3726)	0.412	1.849
			Observations 1278

Table 4: Regression results

The panels summarize our results. Significance level at 1 percent is indicated by ***, 5 percent at **, and 10 percent at *. The dependent variables are the house price indices in percentage. Column 1 reports the results from Oslo compared to Akershus and Buskerud (ex. Romerike) with dummy variables for Frogner and Ullern. Column 2 reports the results from Oslo compared to Akershus and Buskerud (ex. Romerike). Column 3 reports the results of regression 2 by including 2017 January-March. Column 4 reports the results when using Real Estate Norway's data on Oslo compared to Akershus and Buskerud (ex. Romerike).

	1	**2**	**3**	**4**
Variables	Coefficient			
*DD (Post*Oslo)*	-0.0182*** (0.4588)	-0.0144*** (0.003)	-0.0166*** (0.0032)	-0.0147*** (0.0041)
Post	0.0082* (0.0051)	0.0083** (0.0487)	0.0091*** (0.0038)	0.0032 (0.0050)
Oslo	0.0134*** (0.0061)	0.0133*** (0.0060)	0.0118*** (0.0062)	0.0056 (0.0063)
GDP	0.000*** (0.0000)	0.003*** (0.0001)	0.000** (0.0001)	0.000* (0.0000)
Unemployment	0.000 (0.0000)	0.000 (0.0000)	0.000 (0.0000)	0.0000 (0.0000)
Income	0.0254*** (0.0092)	0.025*** (0.0092)	0.024*** (0.0094)	0.0119 (0.0094)
*(Post*Frogner)*	0.0355*** (0.0047)			
*(Post*Ullern)*	0.0234*** (0.0033)			
Observations	1278	1278	1278	978
R-squared	0.4919	0.4274	0.4343	0.3353
Root MSE	0.0126	0.0131	0.0130	0.01394

Table 5 Summary statistic of transaction level data

	2016		2017		2016		2017	
	Self-owned units				Cooperatives			
Variables	mean	s.d.	mean	s.d	mean	s.d	mean	s.d
Price (mln NOK)	3.98	1.59	3.60	1.60	5.30	2.50	6.35	2.60
Sq. meter	63.95	23.18	63.02	22.95	78.01	28.48	84.23	30.10
Floor	2.72	1.65	2.79	1.71	3.06	1.82	3.09	1.71
Rooms	2.60	0.98	2.57	0.95	3.16	2.30	3.17	0.99
Age of building	54.15	39.68	58.58	38.28	33.34	42.85	26.44	41.88

Figure 2: The proportion self-owned units sold in the different regions of Oslo

The panel to the left shows the proportion of self-owned units sold before 2017. The panel to the right shows the proportion of self-owned units sold after 2016. In order to make the panel straightforward we have used some collective terms; St.Hanshaugen, Frogner, Ullern, Sagene, Gamle Oslo, Vestre Aker, Nordre Aker, Grorud, Stovner, Nordstrand, Søndre Nordstrand. Frogner consists of Frogner, Lilleaker, Bestum and Skøyen, Ullern consists of Ullern, Majorstuen, Fagerborg, Homansbyen, Marienlyst, Slemdal, Holmen, Vinderen and Blindern, Sagene consists of Sagene, Grefsen and Kjelsås, Gamle Oslo consists of Gamle Oslo, Alna, Oppsal, Bøler, Bogerud and Manglerud, Vestre Aker consists of Røa, Fossum, Bogstad and Sørkedalen, Nordre Aker consists of Tåsen, Ullevål Hageby, Korsvoll, Kringsjå and Nordberg, Grorud consists of Grorud, Tokerud and Gjelleråsen, Stovner consists of Stovner and Furuset, Nordstrand consists of Østensjø and Nordstrand. The panel shows that the proposition of apartments sold has been quite stable both before and after the regulative implementation.

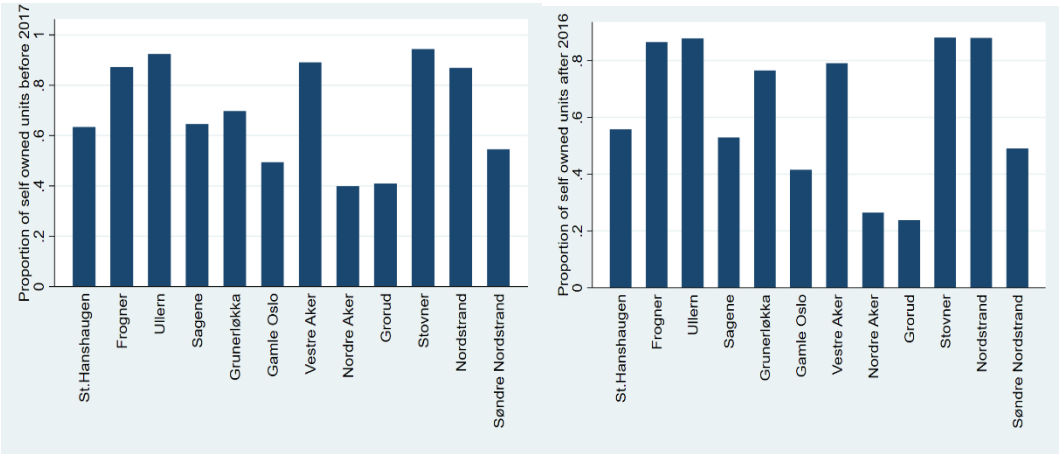

Table 6: Regression results

Regression output using transaction-level data 2006-2018. The dependent variable is the logarithm of the unit price. Treatment is defined as self-owned units in Oslo. Control is defined as cooperatives in Oslo. DID variable is the Post*Self-owned, Self-owned is a dummy equal to 1 if the unit is a self-owned unit, and 0 otherwise. Post is a dummy equal to 1 if the transaction happens after 2017 m3.

Variables	Coefficients		
*DD (Post*Self-owned)*	-0.213*** (0.0141)		-0.248*** (0.0151)
Self-owned	0.422*** (0.0080)		0.437*** (0.0080)
Post	0.925*** (0.0386)		0.930*** (0.0554)
Meter	0.015*** (0.0004)		0.009*** (0.0001)
Meter sq.	-0.0000*** (2.0e-06)		
		*Meter*post*	0.001 (0.0010)
		*Meter sq.*post*	-0.000** (4.75e-06)
1 rooms	0.171*** (0.0404)a	*1 rooms * post*	0.0422 (0.1256)
2 rooms	0.163*** (0.0392)	*2 rooms * post*	0.059 (0.1241)
3 rooms	0.173*** (.03879)	*3 rooms * post*	0.094 (0.1233)
4 rooms	0.167*** (0.0380)	*4 rooms * post*	0.119 (0.1214)
5 rooms	0.074* (0.0383)	*5 rooms * post*	0.133 (0.1248)
5-10 years old	-0.188*** (0.0443)	*5-10 years old * post*	-0.204*** (0.0267)
10-20 years old	0.147*** (0.0444)	*10-20 years old * post*	-0.207*** 0.0281

20-30 years old	-0.186*** (0.04426)	*20-30 years old * post*	-0.298*** 0.0299
30 - 40 years old	-0.181*** (0.0456)	*30 - 40 years old * post*	-0.356*** 0.0334
40-50 years old	-0.250*** (0.0461)	*40-50 years old * post*	-0.361*** (0.0355)
>50 years old	-0.218*** (0.0443)	*>50 years old * post*	-0.321*** (0.0255)
Observations	40.485		40.485
R-squared	0.629		0.617
Root MSE	0.399		0.406

PRELIMINARY MASTER THESIS REPORT

How financial variables influence the house marked in Oslo differently in east and west. The effect governmental regulation has on the Oslo house prices

MSc in Business: Major in Finance
Supervisor: Artashes Karapetyan
Susanne Solfjeld and Marius Vedum Thomassen
Hand in date: January 15th
BI Business School
Nydalen

Content

1.0 Introduction and motivation

Housing prices in Norway play an important role in the overall economy as approximately 80% of norwegians are homeowners (Statistics Norway, 2016). In the US, for instance, household holds close to 18 trillion USD in real estate assets (Agarwal et al., 2013), whereas the Norwegian population of 5 million inhabitants owns real estate amounting to 0.9 trillion USD[1]. Housing investments has overtaken the oil industry as Norway's main driver of economic growth in recent years (Thomson Reuters, 2017), making it feasible to believe that the house prices will be affected by changes in GDP, inflation, interest rate, unemployment, income and net wealth.

The exceeding growth in the house prices in the last decade has prompted a number of regulations being implemented aimed at restraining the abnormal growth. As the growth in house prices has continued over the last 10 years, it would seem that the regulations have had little effect. The price growth continued into 2017, before it shifted. 2017 was also the year that Oslo got even stricter regulations than the rest of the country, insinuating that the regulations implemented did have an effect. In order to make such a statement with certainty we will look at the regulations implemented and their effects, in order to make a conclusion.

1.1 Housing price market in Norway

The housing market in Norway has experienced a growing trend since the early 90's, except from 2008 when they experienced a small decline. Since then, the housing price has been booming every year with an increase in price per square meter of 75% on a national basis[2]. Homes constitute two third of gross household wealth (OECD, 2014) and is one of the most important assets for households. Having a place to live is viewed as a necessary need and close to everyone will be affected by the housing market during their lifetime. Attributes of house prices are also interesting for financial authorities and central bankers. Røed Larsen and Sommervoll (2004) states that housing loans make up a large proportion of credit creation in an economy. Oslo is the city in Norway with highest credit creation in

[1] Statistics Norway, 2012, https://www.ssb.no/en/ifformue
[2]Eiendom Norge, 2017, http://eiendomnorge.no/boligprisstatistikken/

the economy (Business Insider, 2012). The value of housing affects the security of mortgages, which further affect the macroeconomic performance.

1.2 Housing price market in Oslo

Approximately 20 percent of the Norwegian population live in Oslo (Statistics Norway, 2017). Oslo and the suburb areas, which has easy access to work in the area tend to have the highest income per habitant and the highest house prices in Norway (Statistics Norway, 2017). This characteristique might indicate equal demographic areas (Tennøy, 2002). While the whole country has experienced a sharp increase in house prices the last decade, the growth has been superior in Oslo amounting to a growth of price per square meter of 86 percent (Statistics Norway, 2017). Implying an impact even more prominent on the overall economy. Prices, population and demand vary a lot in the different areas in Oslo (Tennøy, 2002). The most concentrated areas are the western part of Oslo where we also find the highest prices. The lowest house prices per square meter are in the east of Oslo. The capital has the highest amount of wealthy people, as well as poor people, highlighting the differences[3]. As presented by the media numerous times over the years, the differences in income are biggest for west and east in Oslo, where east (categorized by Gamle Oslo, Grunerløkka, Sagene, Bjerke, Grorud, Stovner and Alna) have the lowest income and people in the west (categorized by St. Hanshaugen, Frogner, Ullern, Vestre Aker and Nordre Aker) have the highest income. The great variations in price makes it reasonable to believe that financial variables will affect the house prices in Oslo differently, from region to region.

In this thesis we chose to focus solely on the east and west of Oslo because we seek to investigate the areas that are most likely to have different responses to financial variables, which is why we exclude the Centre- and South neighbourhoods.

1.3 Regulatory changes aimed at restraining the housing market

Homeownership in Norway have been a policy goal since 1960 (Eiendom Norge, 2018). Regulations that have been implemented has had a goal of making house

[3] NRK, 2015, https://www.nrk.no/norge/ti-grafer-som-viser-forskjells-oslo-1.12521009

ownership more attractive than renting. The governmental incentives includes tax benefits of credit, no tax on capital gains when selling your apartment/house[4], in addition to the assessed value of the property to be very low for tax purposes, among other things. This way of incentivizing norwegians towards ownership is often referred to as the Norwegian real-estate model.

The real-estate market in Oslo is the most expensive housing price market in Norway (Gjerstad, 2016), and have been prone to additional regulations during the strong appreciation of house prices. The policies aimed at obtaining financial stability. Since the positive price development continued to grow until 2017, the strict capital requirements and loan-to-value limits during the last 10 years did not manage to contain the positive development up until this point. The regulations in 2017 were implemented as an initiative from the Financial Supervisory Authority (FSA) as the housing prices continued to grow substantially more than the household income (FSA, 2016). They were initiated both because of the burden of an average-debt-to-income ratio og 220% and because the NOK had weakened due to investor worries regarding the housing market. In our study we will investigate how regulations imposed by the government in Oslo have affected the housing price market.

In Norway in general among 15%[5] of all homes are secondary homes (NEF, 2016), i.e. the owner does not live in the house/apartment they own. In Oslo, the number of secondary homes are even higher amounting to 19,5%[6] which has been fairly stable over the last years. Within the capital his percentage varies significantly, where the center of Oslo contain 66,1% secondary homes. It has been argued that this high amount of investors buying homes is the main reason for the steep price increase. In 2017 the government imposed new mortgage regulations, where buyers of secondary homes in Oslo now are required to have 40 percent of the equity. The Oslo-specific requirements also included less flexibility for the banks when providing mortgages on the outskirts of the regulations. If it really was the investors of real-estate that created the high prices

[4] Provided that you have lived there for a minimum of 12 months (Skatteetaten, 2018 http://www.skatteetaten.no/no/person/selvangivelse/tema-og-fradrag/bolig/kjop-og-salg/salg-mv-av-fast-eiendom/?chapter=3833)
[5] This number excludes leisure housing
[6] This number excludes leisure housing

in the capital, these regulations would have helped cause the price change of 2017. This is what we will seek to answer in the second part of our research.

1.4 Research Question

In our analysis we look at the influence GDP, inflation, interest rate level, net wealth, income and unemployment rate has on the house prices in Oslo, differentiating east and west to see how they respond differently to each factor. The second part of our analysis will look into how regulations imposed by the government have affected the house prices in Oslo. The existing economic literature does not pay adequate attention to these issues.

The research questions we will seek to answer is the following:

1. How will financial variables influence the house prices in Oslo differently in the east and west?
2. How has the government regulations implemented in 2017 affected the house prices in Oslo?

The remainder of the paper will be organized as follows: chapter 2 will provide an extensive literature review presenting the empirical evidence and theory on the topic and chapter 3 will provide description of methodology to be used in our research.

2.0 Literature review

This section contains previous findings and studies on some of the most relevant areas in relation to our analysis.

The real-estate market is characterized by large fluctuations surfacing over time. As the prices increase or decrease within city lines, this does not mean that the prices have the same trend in each metropolitan areas. Røed and Weum (2008) has studied whether the Norwegian housing market is efficient. A market is categorized as efficient if *it fully and correctly reflects all relevant information in determining asset prices* (Malkiel, 2003). Røed and Weum finds that the Norwegian Housing Market (represented by Oslo) is characterized by inefficiencies. The article utilizes the Case-Shiller efficiency test and find that the Oslo housing market fails the test due to housing prices displaying time structure.

They further claim that the results indicate that a large run-up in prices may very well be followed by a reversion. Such instability of price development in the housing market may imply larger financial instability of the whole economy.

2.1 Empirical evidence regarding research question 1

In the first part of our thesis we will investigate how financial variables influence the housing prices in the eastern and western part of Oslo. Our choice of variables have been conducted on the basis that they describe much of the financial aspects in the economy (Norges Bank, 2011). Empirical evidence find somewhat varying determinants of housing prices.There are both evidence supporting our choice of variables, as well as theory suggesting other variables. Theoretically speaking, there is a direct link between GDP and private consumption, as the latter is a part of the total amount in a country's GDP (Williamson, 2014). This relationship is what connects house prices to a country's GDP. Research focusing on the correlation between house prices and consumption is widespread. Case et. al (2005) shows for instance that variation in housing market wealth have an effect on consumption, concluding that an increase in house prices of 10 percent provides roughly 1,1 percent increase in consumption. This is supported by Case, Quigley and Shiller (2011) who found that there is a generally procyclical relationship between wealth and consumption. Benito et al. (2006) further argues that the relationship between consumption and house prices depends on causal links, such as the influence of house prices on the home equity that people can withdraw from their home to finance spending. This is also supported by Helbling and Terrones (2003) who found evidence that GDP is positively affected by increased house prices. Other empirical evidence find links between house prices and GDP as well as other determinants. Rahman (2010) shows that increasing house prices tend to have a positive effect on household wealth, employment and GDP. Positive correlation between house prices and household wealth is what we would expect to find. As house prices increase this would immediately create a higher household wealth. Additional evidence on this relationship has been provided by Case et.al (2001). They found that wealth and consumption follows the same path, when house prices increases private consumption will go up, which expands the household wealth. There is also a logical reasoning to the positive correlation between employment and house prices. Low unemployment implicates a good state of the market. It is somewhat implicit that in these times demand for

housing will increase, and is consistent with what Larsen and Sommervoll (2003) found. Their research concludes that the housing market is closely linked to the labor market. In areas characterized by unemployment and vacancy, housing will be difficult to sell. This is also in line with what we would expect.

Røed Larsen and Sommervoll (2004) support the aforementioned relationships and suggest adding inflation and interest rates to the equation. They argue that the housing market is composed of factors including interest rates, inflation, and unemployment.The influence of interest rates on house prices will intuitively be negative. An increase in interest rates will increase the monthly cost of your mortgage, lowering the amount you will be able to borrow. Most people will need to borrow money in order to be able to buy a home. In Norway homeowners have on average 1 million NOK in loans in 2015 (Statistics Norway, 2015). Empirical evidence from Ebrahim and Mathur (2003) support this relationship. In their article they state that "*Changes in interest rates will cause inverse changes in housing prices".* Additional evidence suggest both inflation and interest rates will affect house prices. Titman (1982) argues in his paper that a decrease in interest rates will lead to an increase in inflation, which further will lead to house prices increasing as a response to increased demand. He imply that changes in housing prices may affect the aggregate demand and supply of a society, and thus affect inflation. This is supported by Jud and Winkler (2003) who found that an increase in housing prices will indicate higher credit collateral which eventually will push up aggregate demand, consumption and the general price level. Rising house prices will push up the nominal wages of workers to compensate for the rising cost of living, which in turn raise the inflation level (Yu et al., 2016). This relationship is also intuitive as inflation directly affects the purchasing power of the people.

Furthermore, income is also said to have an effect on house prices. Evidence from the US shows that income growth alone explains virtually the entire increase in housing prices for more than forty states, (Case and Shiller, 2003). In addition there is numerous studies (Abraham & Hendershott, 1996; Hort, 1998; Capozza et al., 2002; Meen, 2002) considering house prices to be linked to income by a stable long-run relationship.

Evidence suggest house prices to be influenced by other determinants as well. Muellbauer and Murphy (2008) argue that the drivers of house prices include income, the housing stock, credit availability, demography, and lagged appreciation. Egert and Mihaljek (2007) study the Central and Eastern Europe (CEE). The authors find that prices in eight CEE economies were to a large extent driven by fundamentals such as GDP per capita, real interest rate, housing credit availability, and demographic factors. Another finding is that the development of housing markets and housing finance institutions played a significant role in house price dynamics in the region.

As shown, utilizing financial variables to explain house prices is a well researched area. Our analysis will contribute to existing theory by looking at how metropolitan areas are influenced differently by financial variables. This field of study has, to our knowledge, not been explored. Existing theory in the area focus on regional differences in price due to migration, discrimination and other social interactions, and do not consider the influence brought by financial variables. The prices in the western area of Oslo are found to be significantly higher than the eastern part (approximately 34%) (Granmo et al., 2001). Due to evidence presented above this will indicate differences in wealth, in addition to our knowledge that there are differences regarding unemployment and income in the constitute areas. How financial variables influence these areas differently will therefore provide valuable insights when trying to estimate the response of these areas to changes in the economy.

2.2 Empirical evidence regarding research question 2

Bjørnland and Jacobsen (2010) finds that house prices react strongly to monetary policy shocks. In the article they analyse the relationship between the interest rate changes to housing prices in UK, Sweden and Norway. The paper finds that overall house prices fall 3-5 percent following a monetary change in the interest rate by 1 percent, which is in line with the empirical evidence on the relationship between house prices and interest rates. Consequently, a monetary change regarding interest rates will indeed affect the homeowners wealth. Bjørnland and Jacobsen (2010) find the house price response varies in strength and timing across countries. In regard to our analysis the only inference we can make from this is

that monetary policies may have an effect on the house prices. Further, Larsen and Sommervoll(2003) points out that access to credit is crucial for a proper functional housing market. The credit conditions are linked to the economic situation as credit is given on the assessment of a borrower's ability to pay. Reducing the amount a borrower is able to get will then most likely affect the housing market. To some extent this is supported by empirical result from Linneman and Wachter (1989), and Zorn (1989). They provide evidence that down payment requirements can constrain households in their purchase of a home. Haurin, Hendershott and Wachter (1996) also claim that homeownership is significantly reduced by borrowing constraints.

The evidence presented above can be used as indicators for our hypothesis, but as the research is highly limited regarding the following analysis it underlies the importance of our research in this master thesis.

3.0 Methodology

This paper's contribution is empirical. As we have two research question we will investigate, we have two different approaches to test our hypothesis.

3.1 How will financial variables influence the house prices in Oslo differently in the east and west?

In the main part of our analysis we wish to use regression analysis, where we will use monthly real-estate prices in Oslo in the time period 2010-2017. We will structure the analysis into comparing the influence of financial variables to the west and east of Oslo. We categorize east as the area including; Gamle Oslo, Grunerløkka, Sagene, Bjerke, Grorud, Stovner and Alna. The western part of Oslo is categorized by St. Hanshaugen, Frogner, Ullern, Vestre Aker and Nordre Aker. Our regression analysis will regress house prices of each area to the financial variables; GDP, income, inflation, unemployment, net wealth and interest rates. The data needed for this analysis is assumed to be public, available data, which we will retrieve from the following sources: housing data will be collected from the Norwegian Association of Real Estate (NEF) and Statistics Norway (SSB). The financial variables will be collected from several sources. From SSB we will collect data on income and overall net wealth. Data on inflation, GDP and interest rates will be collected from The Norwegian Central Bank. Unemployment rates will be gathered from The Norwegian Labour and Welfare Administration (NAV).

All the datasets aforementioned are sequences of numerical data point in successive order, also known as time-series. We will be utilising a linear regression model. Brooks (2008) defines a linear regression as a way of explaining the movements on the dependent variable, in our case housing prices, by explanatory variables, here independent financial variables. We seek to investigate how the financial variables may impact the housing prices differently in east and west of Oslo by using Ordinary Least squares (OLS). Secondly, we will be using Cross validation (CV) for accuracy. CV models divide the dataset into smaller subgroups, to perform a separation in order to future validate the model.

3.2 How has the government regulations implemented in 2017 affected the house prices in Oslo?

In the second part of the thesis we will look at how the regulations implemented in 2017 have affected the house prices in Oslo. There were several regulations affecting all of Norway. We will be looking into the Oslo-specific regulations implemented 1st of January 2017. This involves the 40 percent equity requirement on the purchase of a secondary home in addition to the narrowed flexibility of banks providing mortgages on the outskirts of the restrictions imposed by the government.

For the following method to obtain what is intended we need house price data from the beginning of 2016 until the end of 2017.

The hypothesis we will test is the following:
H0: The Oslo specific regulations did not have significant effect on the real-estate market
HA: The Oslo specific regulations did have a significant effect on the real-estate market.

3.2.1 Difference-in-Difference

The methodology we will use is the difference-in-difference estimator. This method is useful when evaluating a sharp change in the government policies or economic environment. It is also a useful method when facing endogeneity issues, which often is a problem in corporate finance. In the following there will be a presentation of single difference estimator in order to motivate the use of DD. First we have the single cross-sectional differences after treatment. This method indicates looking at at treatment group (where the effect you want to measure is implemented) and a control group (where the change was not implemented), and compare the two in order to evaluate the effect of the change (Roberts & Whited, 2012). Harvey and Hanka (1999) utilized this method to estimate the effect of a state antitakeover law on leverage. They compared the firms in states that passed the law (which they call the treatment group), with the firms in the state that did not pass the law (which are called the control group). This study is quite similar to the one we will perform, by evaluating the effect of a certain law. This method is used when there is no data available on the pre-treatment outcome, and

consequently does not account for changes existing post-treatment. As more data is available to us, this method could be improved. The second usage is the single time-series difference before and after treatment. Compared to the first method, this one only looks at the treatment group before and after the treatment, not focusing on a control group. Blanchard, Lopez-de-Silanes, and Shleifer (1994) utilized it when comparing a number of corporate outcomes (e.g. investments, dividends, assets sales etc.) before and after large legal rewards. This is a common approach when the event affects all observable subjects. Our analysis will evaluate the effect of regulations specifically in Oslo, and as data exist for both before and after the "treatment", we could improve our method even further. This highlights the benefits of utilising the DD. DD implements both of the aforementioned methods; by looking at both the treatment and control group, before and after the event, we may be able to avoid certain endogeneity problems. In 2017 the government imposed several regulations in all of Norway, as well as certain restriction only regarding Oslo. Using DD will help distinguish the effects from the overall regulations from the Oslo-specific regulations. An example similar to the approach we will have is the one by Bertrand and Mullainathan (2003). They looked at firms in Arizona and Connecticut, where in Arizona they had passed an antitakeover legislation which was not passed in Connecticut. The paper used the year where the legislation was implemented, 1987, as the post-treatment year, and the year before, 1986, as the pre-treatment year. Further, firms registered in Arizona represented the treatment group, and firms registered in Connecticut represented the control group.

The regression model for the DD estimator is:

$$y = \beta_0 + \beta_1 txp + \beta_2 t + \beta_3 p + u, \quad (1)$$

or, in differences

$$\Delta y = \beta_0 + \beta_1 t + \Delta u \quad (2)$$

where t is the treatment variable equal to 1 if the firm is registered in Arizona, and zero otherwise, p is the post-treatment indicator equal to 1 in year 1987 and zero in year 1986. Including the variable t will control for permanent differences between the treatment and control group, while including the variable p will control for differences common to both groups. This way the variation that

remains is the variations caused by the antitakeover law in Arizona, relative to the changes in Connecticut. This variation is captured by the B1, the DD estimate.

This method represents an identical approach as the one we will use, where Oslo will be the treatment group and a county with similar characteristics as Oslo will represent the treatment group. The post-treatment year will be 2017, and the pretreatment year will be 2016.

4. Bibliography

Bertrand, Marianne and Sendhil Mullainathan, (2003).
Enjoying the quiet life? Corporate governance and managerial preferences,
Journal of Political Economy 111, 1043-1075.

Bjørnland, H. C., & Jacobsen, D. H. (2010). The role of house prices in the monetary policy transmission mechanism in small open economies.
Journal of financial stability, 6(4), 218-229.

Blanchard, Olivier Jean, Florencio Lopez-de-Silanes and Andrei Shleifer, (1994).
What do firms do with cash windfalls?
Journal of Financial Economics 36, 337-360.

Bloomberg. (2017). *Private consumption affect GDP*. Retrieved 10.01.2018.
https://www.bloomberg.com/news/articles/2017-03-31/turkey-private-consumption-boosts-gdp-growth-above-all-estimates

Brooks, Chris. (2008). Introductory Econometrics for Finance. 2nd ed. UK: Cambridge University Press.

Capozza, D. R., Hendershott, P. H., Mack, C., & Mayer, C. J. (2002). Determinants of real house price dynamics (No. w9262). National Bureau of Economic Research.

Case, K. E. and Shiller, R. J, (1989). "The Efficiency of the Market for SingleFamily Homes." The American Economic Review 79 (1): 125-137.

Case, K.l E., "The Real Estate Cycle and the Economy: Consequences of the Massachusetts Boom of 1984-1987," Urban Studies, 29, 1992: 171-183.

Case, K. E., Quigley, J. M. and Shiller, R. J. (2005).
"Comparing Wealth Effects: The Stock Market versus the Housing Market".
Journal of Macroeconomics: Advances in Macroeconomics 5 (1): 1-32.

Case, K. E., Quigley, J. M. and Shiller, R. J. (2011):
"Wealth Effects Revisited 1978-2009," NBER Working Paper 16848.

Campbell, John and João Cocco, (2004).
"How Do House Prices Affect Consumption? Evidence from Micro Data,"
unpublished paper, Harvard University,.

Ebrahim, M. S., & Mathur, (2003). A MODIFIED GENERAL EQUILIBRIUM ANALYSIS OF HOUSING PRICES AND INTEREST RATES.

Égert, B., & Mihaljek, D. (2007). Determinants of house prices in central and eastern Europe. Comparative economic studies, 49(3), 367-388.

Eiendom Norge. (2018). Den norske boligmodellen. Retrieved 12.01.18
http://eiendomnorge.no/hovedsaker/den-norske-boligmodellen/

Finanstilsynet. (2016). Finansielle utviklingstrekk 2016. Retrievet 12.01.18 https://www.finanstilsynet.no/nyhetsarkiv/pressemeldinger/2016/finansielle-utviklingstrekk-2016/

Garvey, Gerald T. and Gordon R. Hanka, (1999), Capital structure and corporate control: The effect of antitakeover statutes on firm leverage, Journal of Finance 54, 519-546.

Gjerstad, Linn. (2016, February 10th). Her er de høyeste boligprisene i Norge nå. *Aftenposten*. Retrieved 12.01.18 https://www.aftenposten.no/bolig/Her-er-det-de-hoyeste-boligprisene-i-Norge-na-9097b.html

Haurin, D. R., Hendershott, P. H., & Wachter, S. M. (1996). Borrowing constraints and the tenure choice of young households (No. w5630). National bureau of economic research.

Helbling, T. and Terrones, M. (2003). Real and financial effects of bursting asset price bubbles. IMF World Economic Outlook, April, 6194.

Hendershott, Patric, H. (1987) National Bureau of Economic Research. Retrieved 12.01.18 http://www.nber.org.ezproxy.library.bi.no/papers/w2245.pdf

Hort, K. (1998). The determinants of urban house price fluctuations in Sweden 1968–1994. Journal of housing Economics, 7(2), 93-120.

Jud, G. D., & Winkler, D. T. (2003). The Q theory of housing investment. The Journal of Real Estate Finance and Economics, 27(3), 379-392.

Kennickell, Arthur B. and Annamaria Lusardi, (2004) "Disentangling the Importance of the Precautionary Saving Motive,"
NBER Working Paper No. 10888,.

Kennickell, Arthur B., and Martha Starr-McCluer. (1983),
"Retrospective Reporting of Household Wealth: Evidence from the 1983-89 Survey of Consumer

Larsen, E. R., & Sommervoll, D. E. (2003). Rising inequality of housing?: evidence from segmented housing price indices.

Larsen, E. R., & Sommervoll, D. E. (2003). Towards the sky or off the cliff? A catalogue of explanations of rising prices of housing, SSB, 2003/64

Larsen, E. R. and Sommervoll, D. E. (2004). "Rising Inequality of Housing: Evidence from Segmented House Price Indices." Housing, Theory and Society 21 (2): 77-88.

Larsen, E. R., & Weum, S. (2008). Testing the efficiency of the Norwegian housing market. Journal of Urban Economics, 64(2), 510-517.

Larsen, E. R. and Weum, S. (2008). "Testing the efficiency of the Norwegian housing market." Journal of Urban Economics 64 (2): 510-517.

Linneman, P., & Wachter, S. (1989). The impacts of borrowing constraints on homeownership. Real Estate Economics, 17(4), 389-402.

Linder, Sofia. (2013) "Två år med bolånetaket." Report, Måklarsamfundet,.

Lorch-Falch, S. (2016). E24. Retrieved 10.01.18 https://e24.no/privat/raymond-johansen/saa-mange-oslo-boliger-maa-bygges-for-aa-loese-boligmangelen/23764214

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. Journal of Economic Perspectives, 17(1), 59-82.

Meen, G. (2002). The time-series behavior of house prices: a transatlantic divide?. Journal of housing economics, 11(1), 1-23.

Muellbauer, J., & Murphy, A. (2008). Housing markets and the economy: the assessment. Oxford review of economic policy, 1-33.

NEF - The Norwegian Association of Real Estate. (2016). Retrieved 12.01.18 http://www.nef.no/nyheter/statistikk-651-flere-sekundaerboliger-oslo-2016/

Norges Bank (2011). Pengepolikken og sammenhenger i Norsk økonomi. Retrieved 12.01.18 http://www.norges-bank.no/Publisert/Foredrag-og-taler/2011/05092011-CME/

Rahman, M. M. (2010). The Australian housing market–understanding the causes and effects of rising prices. Policy studies, 31(5), 577-590.

Roberts, M. R., & Whited, T. M. (2012). Endogeneity in empirical corporate finance.

Røed Larsen, Erling. (2013). "Did the 2008 Monetary Policy Reversal in Norway Reverse the Housing Market?"

Skinner, Jonathan. (1989), "Housing Wealth and Aggregate Saving," Regional Science and Urban Economics, 19, 1989: 305-324.

Statistics Norway (SSB). (2017). "Boligprisstatistikk 2017". Retrieved 10.01.18 https://www.ssb.no/befolkning/statistikker/beftett

Statistics Norway (SSB). (2016). "Boforhold". Retrieved 10.01.18 https://www.ssb.no/bygg-bolig-og-eiendom/statistikker/boforhold/aar/2016-09-29

Statistics Norway (SSB). (2016). "80% eier egen bolig i Norge". Retrieved 09.01.18 https://www.ssb.no/bygg-bolig-og-eiendom/statistikker/boforhold/aar/2016-09-29

Titman, S. (1982). The effects of anticipated inflation on housing market equilibrium. The Journal of Finance, 37(3), 827-842.

Thomson Reuters, (2017). “Norway’s economy vulnerable to house prices”. Retrieved 10.01.18 https://www.reuters.com/article/norway-banks-regulator/update-2-norways-economy-vulnerable-to-house-prices-bank-regulator-idUSL8N1NZ2AI

Williamson, D., S. (2014). Macroeconomics (5th edition). Harlow: Pearson Education Limited.

Zorn, P. M. (1989). Mobility-Tenure Decisions and Financial Credit: Do Mortgage Qualification Requirements Constrain Homeownership?. Real Estate Economics, 17(1), 1-16

Yu, H., & Huang, Y. (2016). Regional heterogeneity and the trans-regional interaction of housing prices and inflation: Evidence from China’s 35 major cities. Urban Studies, 53(16), 3472-3492.